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USAAVLABS TECHNICAL REPORT 68-80

CH-47A CHINOOK ENGINE LOAD SHARING

ENGINEERING LABORATORY REPORT

By

L. R. Bartek

R. Hunt

November 1968

U. S. ARMY AVIATION MATERIEL LABORATORIES
FORT EUSTIS, VIRGINIA

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Project 1M131201D14415, House Task EL 65-29
USAAVLABS Technical Report 68-80
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SUMMARY

The Army is concerned with the problem of unequal load sharing by the engines in its multiengine helicopters. Findings of an engine load-sharing study conducted on the CH-54A Skycrane helicopter in 1965 led to a similar study on the CH-47A Chinook helicopter.

Airspeed, altitude, engine gas producer rpm, engine torque, exhaust gas temperature, main rotor rpm, and outside air temperature were recorded during various flight conditions. The gross weight at takeoff and landing and the barometric pressures were also recorded as supplemental data. The data are presented in a series of histograms and tables showing the variations in engine load sharing as a function of the other aircraft parameters.

It was found that for the CH-47A Chinook, the relative frequency of occurrence of torque splits greater than 20 percent is less than one-half that for the CH-54A Skycrane.

FOREWORD

This report was prepared under Project 1M131201D14415, House-Task 65-29 as a follow-up to an earlier engine load-sharing study performed on the CH-54A Skycrane helicopter.

Acknowledgment is given to Technology Incorporated for acquiring the engine load-sharing data in conjunction with a concurrent operational flight-loads study in Vietnam. Mr. Joseph F. Braun, the project engineer, and Mr. Bob Englehart, a field technician, were primarily responsible for the recording of 346.59 hours of operational flight data on the unarmed CH-47A aircraft.

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INTRODUCTION

The U. S. Army Aviation Materiel Laboratories (USAAVLABS) is involved in research and advanced development of multiengine heavy-lift helicopters. An important consideration in the design of these aircraft is the load distribution between the engines. In 1965 a study was conducted of engine load-sharing characteristics of three instrumented twin-engine CH-54A Skycrane helicopters at Fort Benning, Georgia.* As a follow-up to that program, data were collected from four instrumented twin-engine CH-47A Chinook helicopters operating in Vietnam from January 1966 to May 1967.

The same parameters were measured for the CH-47A Chinook as for the CH-54A Skycrane except that two exhaust gas temperature measurements were added to the Chinook instrumentation in order to obtain a more accurate gage of engine performance.

An oscillograph recording system was used to record data on the following parameters: airspeed, altitude, main rotor rpm, engine gas producer rpm, engine torque, outside air temperature, and exhaust gas temperature. Vertical acceleration at the aircraft's center of gravity, barometric pressure, and aircraft gross weight were also measured and recorded as supplemental data.

The data were scanned for significant engine torque splits, and sample points were selected for presentation. The measured parameters were reduced by standard methods, and histograms were drawn to relate the torque splits to the other parameters.

*L. R. Bartek and David Chestnutt, CH-54A SKYCRANE ENGINE LOAD SHARING, USAAVLABS Technical Report 66-47, U. S. Army Aviation Materiel Laboratories, Fort Eustis, Virginia, May 1966, AD 634503.

OBJECTIVES

Following are the objectives of this study:

1. To obtain an estimate of the frequency of occurrence and the severity of unbalanced engine loading conditions on the CH-47A Chinook helicopter.

2. To establish the aircraft flight conditions at which the engine load unbalance is most severe.

3. To compile data to permit a comparison of the engine torque splitting characteristics of the CH-47A Chinook with those of the CH-54A Skycrane previously investigated.

PROCEDURES

INSTRUMENTATION

The engine parameters (exhaust gas temperature, torque, gas producer rpm, and main rotor rpm) were obtained in a manner such that the values recorded were equivalent to cockpit instrument readings. The actual aircraft instrumentation systems were used for signal generators.

Airspeed was measured by attaching a differential pressure transducer to the aircraft pitot system, pressure altitude was measured by tapping the aircraft static pressure system and utilizing an absolute pressure strain-gage transducer, and outside air temperature was measured by gluing a resistance-type thermoribbon to the underside of the aircraft.

This engine load-sharing study was conducted in conjunction with an operational flight-loads measurement program. Parameters recorded but not used in the engine load-sharing study included: vertical acceleration at the aircraft's center of gravity, collective stick position, and longitudinal cyclic stick position. All of the signals generated by the instrumentation systems aboard the aircraft were recorded on a Century Model 409B oscillograph recording unit. A block diagram of the instrumentation and recording system is presented in Figure 1.

DATA REDUCTION

Sample Selection

The data from which samples were collected were grouped into two categories: (1) data in which instrumentation was complete and operating properly, and (2) data in which one or more channels were malfunctioning but the torque instruments were operating as intended. Also included in category 2 were data collected early in the program, when only one exhaust gas temperature and one gas producer rpm were being monitored. Tables I and II constitute the compilation of data samples representing category 1 and category 2, respectively.

Data accumulated totaled 346.59 hours; 202.57 hours were in category 1, and 144.02 hours were in category 2. Data samples were selected by scanning the total 346.59 hours of data and looking for instances in which

the torque difference between the two engines was greater than 10 percent. When this type of condition was located and the data were in category 1, data points were calculated for all pertinent parameters. The data samples included points in the steady-state portions of the record, preceding and following the torque split, as well as points during the peak split period. The 186 samples in category 1 contained a total of 613 data points. This indicates a ratio of 3.32 data points per sample. Thus, most of the torque splits were defined by taking only one or two points at the extreme torque-split portions of a sample. For the data in category 2, only torque was calculated. The data were segregated to promote uniform comparability among data samples. If malfunctioned or incomplete data had been included with category 1 data, the frequency-of-occurrence distributions might have been distorted by the absence of affected parameters.

Whenever a torque split of greater than 10 percent occurred and remained steady, only one sample was selected for calculations. If the torque-split condition was cyclic in occurrence, with splitting and balancing alternating, a sample was selected for each cycle that occurred. Because this method of selecting samples was used, the total time during which torque splits of greater than 10 percent existed is larger than the total time utilized in calculating data points.

The total time represented by the sample points in category 1 is 4.34 hours; this time represents 2.1 percent of the total time from which data were selected.

Data Processing

After the data samples were selected for analysis, the individual points were calculated for tabulation. The oscillograph record contained a reference trace, and measurements were made to establish the deflection existing between each active channel and the reference. This deflection was compared with the amount of deflection present at a zero point or known magnitude level for each channel. A calibration factor was applied to the deflection between an active data point and its respective known reference level in order to calculate the physical magnitude of the quantity being measured. This general method of data reduction was applied to all parameters except gross weight and time.

Initial oscillograph chart speed was set at 4 inches per minute, but the actual speed varied from +23 percent to -11 percent. To correct for fluctuations in paper speed, a time calibration was run for each chart. This was accomplished by turning the voltage channel off for a known time while the recorder chart was running. The ratio of chart length

run in a known time to the distance it should have run at the rate of 4 inches per minute yielded a multiplying factor with which to calculate the correct chart speed. Time was calculated to the nearest 0.1 minute. When a record was edited for processing, a template was used which marked time panels as if the 4-inch-per-minute chart speed were always in effect. Later, when the data were analyzed, the time correction factor was applied. The gross weights were calculated by using a supplemental data sheet which accompanied each record. The takeoff gross weight and the fuel consumption rate were listed by the technician in the field. To calculate the gross weight at any known time, the fuel consumption rate was multiplied by the time from takeoff; this weight was then subtracted from the takeoff gross weight. Any cargo pickups or drops were added to or subtracted from the weight calculated on the basis of fuel consumption rate.

To illustrate, sample calculation 4, point 1, flight 84A follows:

Time

Time panel, 55.4 minutes
Volts off, 60 seconds
Length of deflected voltage trace, 4.46 inches
Theoretical length of trace, 4.00 inches

$$\text{Time correction factor} = \frac{4.00 \text{ inches}}{4.46 \text{ inches}} = .897$$

True time = (time panel) (time correction factor)
True time = (55.4) (0.897) = 49.69 minutes
True time to nearest 0.1 minute = 49.7 minutes

Gross Weight

The takeoff gross weight was listed as 23,087 pounds. The fuel consumption rate was 39.0 pounds per minute for 30.8 minutes; it then changed to 34.0 pounds per minute when a 1200-pound load was picked up by the aircraft. The amount of fuel used in 30.8 minutes, at 39.0 pounds per minute, was 1201 pounds. An additional 643 pounds of fuel was used when flying for 18.9 minutes at a fuel rate of 34.0 pounds. Thus, the gross weight of the helicopter at 49.7 minutes was 22,443 (23,087 - 1201 + 1200 - 643). Since only three significant digits were carried, the value 22,400 pounds appears in the table.

Torque

To calculate the torque on each engine, the deflection of each torque trace from the reference was measured with zero torque applied. In this case, the deflection was 2.32 inches for torque 1 and 2.01 inches for torque 2. At 49.7 minutes, the deflections of torques 1 and 2 from the reference were 2.74 inches and 2.48 inches, respectively. The difference in deflections from the zero loading condition was proportional to the torque applied on each engine. The slopes on the torque-measuring instruments for engines 1 and 2 were 0.770 percent per 0.01-inch deflection and 0.730 percent per 0.01-inch deflection, respectively. From this information, the following calculations were made:

Torque 1: (2.74 in. - 2.32 in.) (0.770 pct/0.01 in.) = 32.3 pct

Torque 2: (2.48 in. - 2.01 in.) (0.730 pct/0.01 in.) = 34.3 pct

Torque split: 34.3 pct - 32.3 pct = 2.0 pct

$$\text{Average torque} = \left(\frac{\text{Torque 1} + \text{Torque 2}}{2}\right)$$

$$= \left(\frac{32.3 + 34.3}{2}\right) = 33.3 \text{ pct}$$

Other Engine Parameters

Main rotor rpm, gas producer rpm, and exhaust gas temperature were calculated similarly to the torques.

Airspeed

A slightly varied calculation procedure was adapted for airspeed calculations. The differential pressure of the aircraft's pitot-static airspeed instrumentation system was used in conjunction with a table of differential pressures and airspeeds to calculate airspeed. At 49.7 minutes, the airspeed trace was 1.30 inches

from the reference. The calibration factor for the pressure-measuring instrument in use was 0.4846 inch of mercury. The calibration pulse with a known resistance in the circuit was a 1.66-inch deflection. Therefore, the calibration constant was 0.4846 inch of mercury per 1.66-inch deflection. Following are the steps used to calculate a pressure difference due to airspeed:

Pressure differential = (1.30 in. - 0.38 in.) (0.4846 in. Hg/ 1.66 in. deflection) = 0.2686 in. Hg

From a table of differential pressures in inches of mercury and velocities in knots, interpolation will yield the airspeed in knots, as follows:

0.2686 in. Hg corresponds to 74.7 kn

Figure 2 shows a reproduction of the segment of an oscillograph record from which sample 4 was calculated.

RESULTS

For the data sampled, a torque split of 20 percent or less occurs 85 percent of the time (see Figures 3 and 4). Since almost two-thirds of the sample points are the steady values preceding or following the torque split, this distribution appears to be reasonable. The remaining 15 percent of the torque-split points are spread fairly evenly from 20 percent to 100 percent.

The average torque level of more than 85 percent of the data points is between 10 percent and 50 percent (see Figure 5). This figure and all succeeding histograms are based on the category 1 data in which each sample point consists of a complete set of parameters.

Figures 6 through 13 show the ranges of average torque versus frequency of occurrence by 10-percent torque-split brackets up to the 70- to 100-percent range. These histograms illustrate how the torque splits are distributed by average torque level.

Figures 14, 15, and 16 show frequency of occurrence versus average torque ranges in percent for torque splits of greater than 10 percent during descent, steady-state, and high-power conditions (ascent, hover, and maneuver), respectively. During descent, more than 70 percent of the points fell in the category of less than 30 percent average torque. The bulk of the data in the steady-state and high-power distributions was between 20 percent and 70 percent. It would be expected that the average torque for torque splits in descent would be lower than in the other operational conditions since descent is ordinarily a low-power flying condition.

Table III lists the sample points and indicates which flight-mode category each falls into. Nearly two-thirds of the 186 data samples are in the descent mission segment. This indicates that most torque splits occur at low-power conditions and are necessarily of small magnitude.

Frequency of occurrence versus ranges of torque splits for torque splits of greater than 10 percent for various mission segments is plotted in Figures 17, 18, and 19; these figures can be used in conjunction with Figures 14, 15, and 16 to show the distribution of torque splits by descent, steady-state, and high-power operating conditions, respectively. These histograms also give an indication of how much power the aircraft were using during the torque splits. The significance of a given

magnitude torque split is dependent upon average torque of the two engines as well as absolute magnitude

Figures 20, 21, and 22 show exhaust gas temperature splits versus frequency of occurrence for descent, steady-state, and high-power mission segments with torque splits of greater than 10 percent. In all three operating conditions, 75 percent of the exhaust gas temperature splits were 200°F or less. Figure 23 shows exhaust gas temperature splits versus frequency of occurrence for the 618 sample points; 92 percent of them are less than 200°F. Since the torque-split sample points of less than 10 percent are included in these data, one would expect exhaust gas temperature splits to be smaller on a percentage basis. Figures 24 through 32 break down frequency of occurrence of exhaust gas temperature splits by 10-percent torque split, with brackets from 0 to 80 percent; the last bracket extends from 80 to 100 percent.

Frequency of occurrence versus variation in gas producer rpm between two engines for the total 618 sample points is plotted in Figure 33. At 80 percent of the points, the difference in rpm between the engines is less than 4,000. These data correlate well with torque-split data, since torque is a function of gas producer rpm. Figures 34 through 43 display the variation in gas producer rpm between two engines versus frequency of occurrence over the range of torque splits from 0 to 100 percent.

Nearly 70 percent of the torque-split sample points occurred at gross weights of 20,000-24,000 pounds (see Figure 44). This is to be expected, as the aircraft takeoff weight with crew and a full load of fuel with no cargo is 23,087 pounds. In Figures 44 through 53, gross weight is plotted versus frequency of occurrence of sample points at torque-split brackets of 10 percent from 0 to 80 percent; the last bracket extends from 80 to 100 percent.

In Figures 54, 55, and 56, gross weight versus frequency of occurrence is plotted for each category of operating conditions. The 20,000-24,000-pound gross weight range still dominates the figures.

Two-thirds of the torque-split samples occurred in descent mission segments (see Figure 57). The fewest torque splits occurred during high-power mission segments.

Ninety-four percent of the torque-split sample points occurred at main rotor rpm's between 225 and 240 (see Figure 58). This distribution could be expected, since the normal operating rpm for this helicopter is between 230 and 233.

In Figures 59 through 67, main rotor rpm is plotted vers .s frequency of occurrence for torque-split brackets covering the full range of torque splits.

The histogram of airspeed versus frequency of occurrence of sample points (Figure 68) shows that one-fourth of the data points occurred at less than 10 knots' airspeed and 70 percent at less than 70 knots' airspeed. Since so many of the torque splits occurred during descents and ascents, one would expect the low-airspeed data points to dominate the distribution of data.

Figures 69 through 77 show distribution of airspeed versus frequency of occurrence by ranges of torque splits; Figures 78, 79, and 80 show distribution of airspeed versus frequency of occurrence by mission segment.

CONCLUSIONS

It is concluded that:

1. Torque splits of greater than 10 percent for the CH-47A Chinook occur about once per flight hour. (During the 346.59-hour sample period, momentary torque splits of greater than 100 percent were experienced five times.)

2. Torque splits occur most frequently in the descending mode of flight. High-power conditions are least susceptible to unbalanced engine loading.

3. The CH-47A Chinook encountered torque splits of greater than 20 percent on 15.6 percent of the sample points in the study. (The CH-54A Skycrane encountered torque splits of greater than 20 percent on 36.5 percent of the sample points.)

4. Engine torque splits are not a significant problem at high-gross-weight flying conditions.

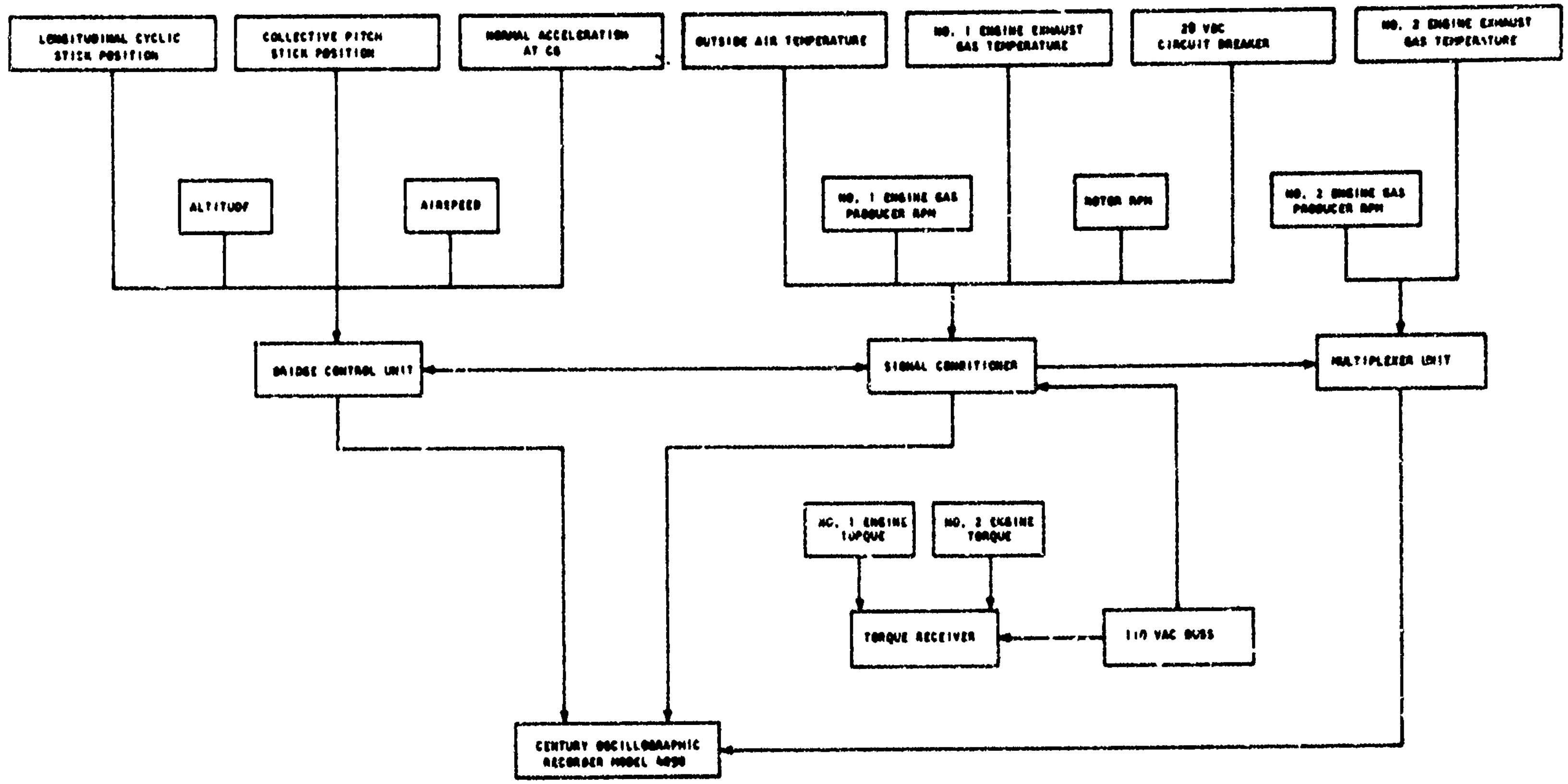

Figure 1. Block Diagram of CH-47A Instrumentation System.

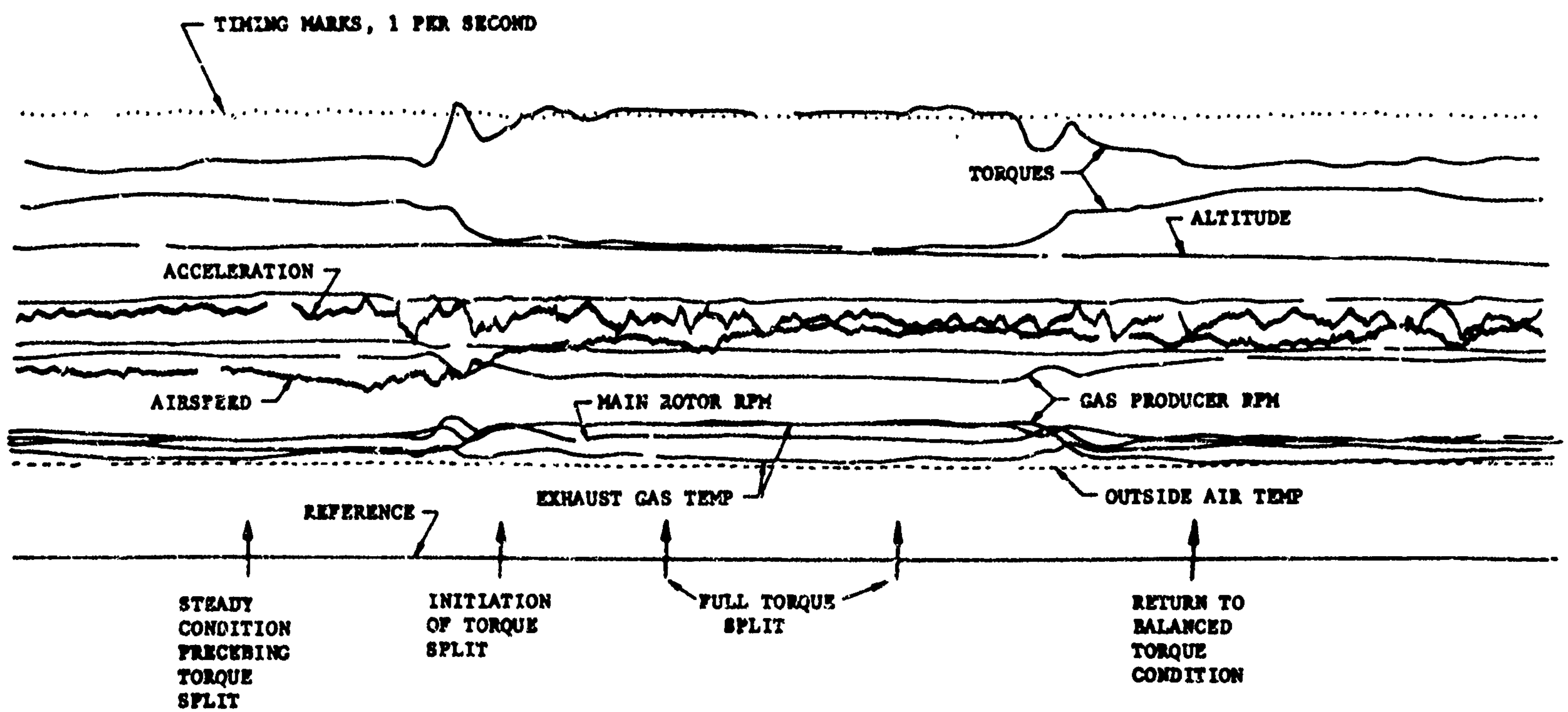

Figure 2. Sample Oscillograph Record.

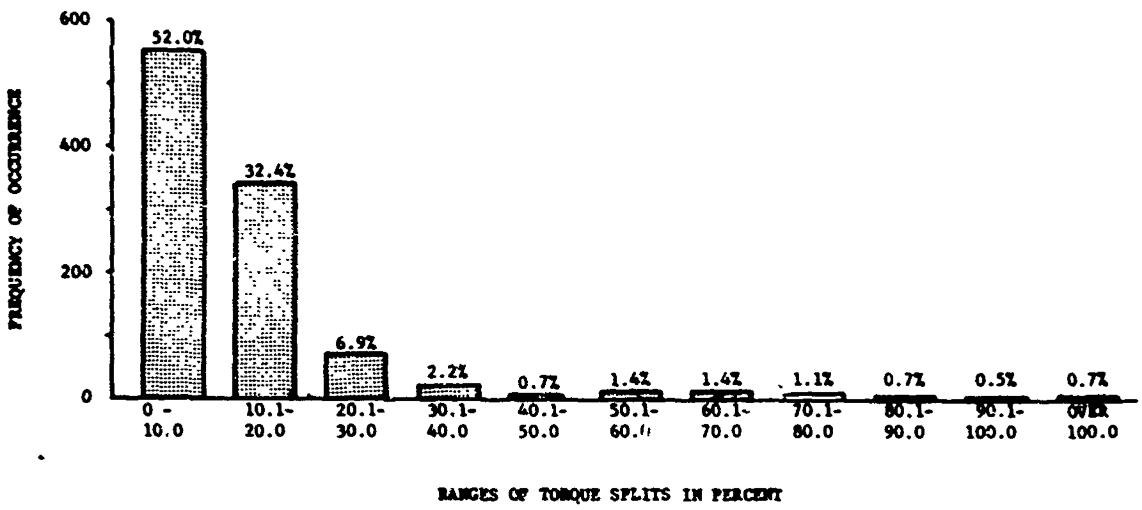

Figure 3. Summary: Torque Splits Versus Frequency of Occurrence (1059 Sample Points, All Data).

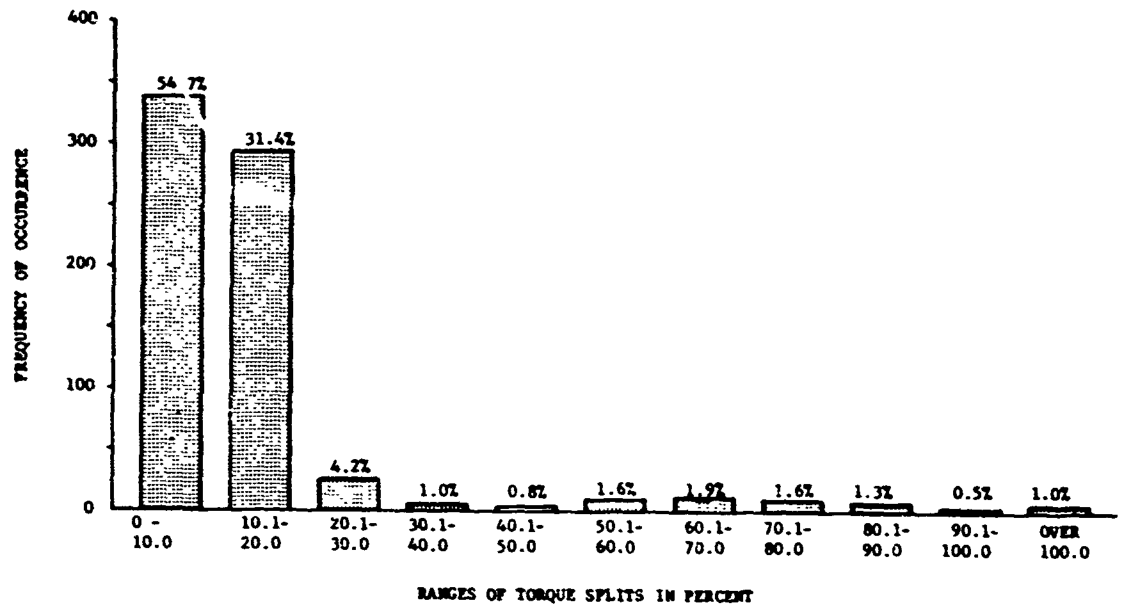

Figure 4. Summary: Torque Splits Versus Frequency of Occurrence (618 Sample Points, Table I Data).

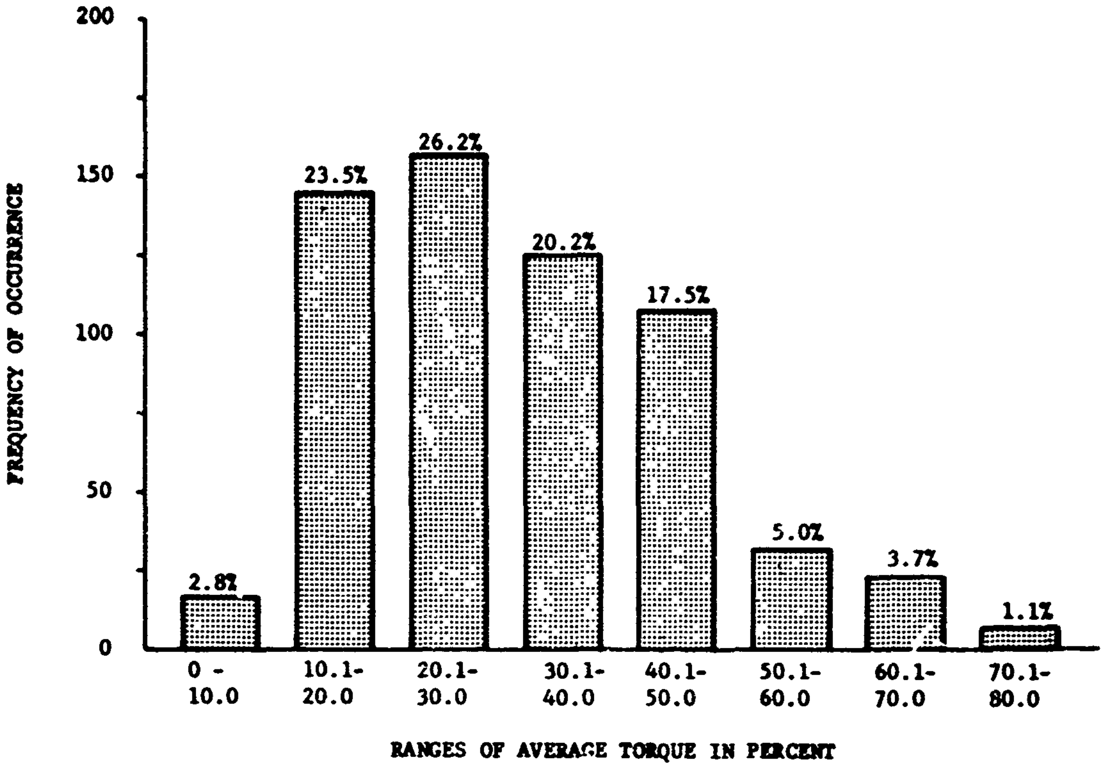

Figure 5. Summary: Average Torque Versus Frequency of Occurrence (618 Sample Points, Table I Data).

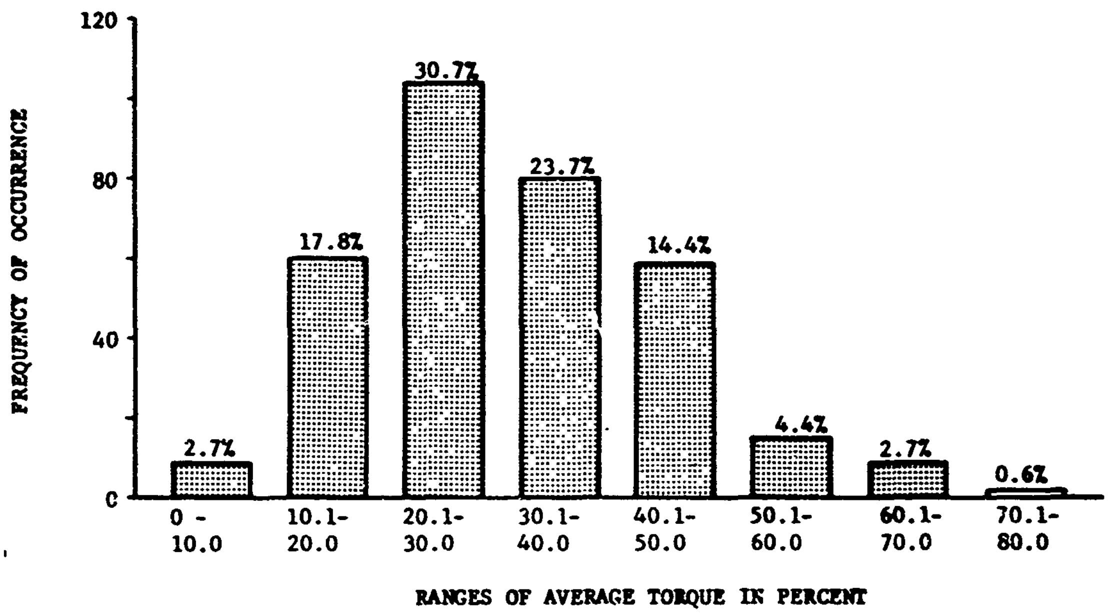

Figure 6. Average Torque Versus Frequency of Occurrence at 0- to 10-Percent Torque Split (338 Sample Points, Table I Data).

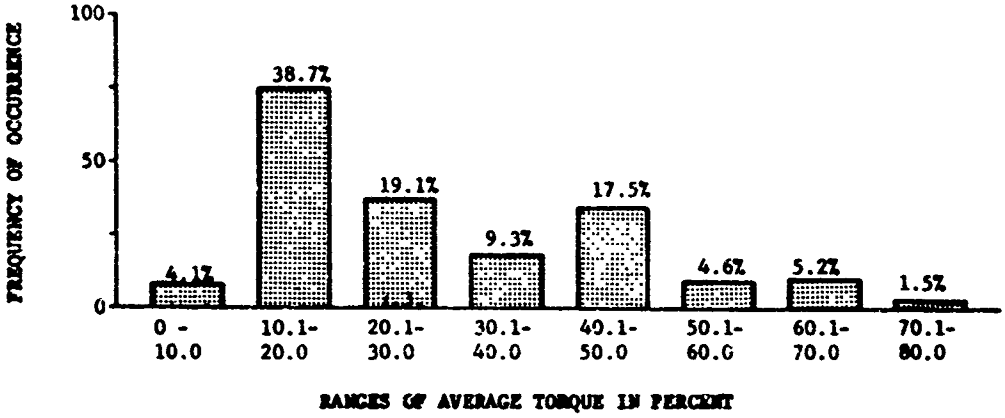

Figure 7. Average Torque Versus Frequency of Occurrence at 10- to 20-Percent Torque Split (194 Sample Points, Table I Data).

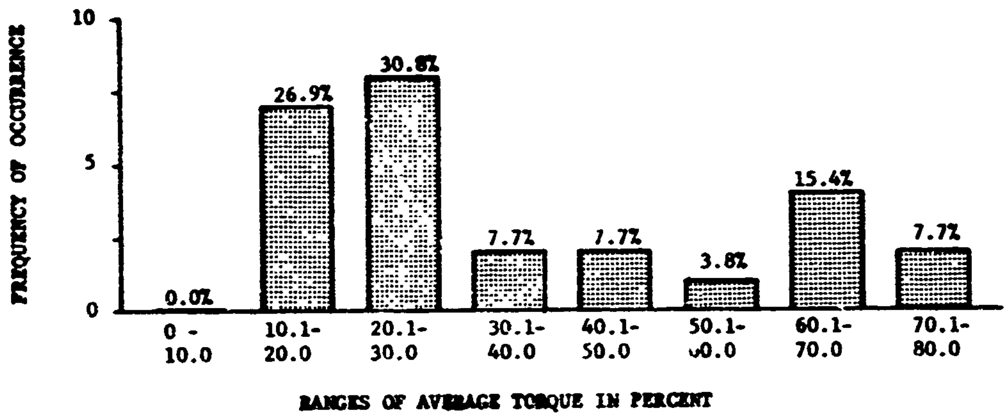

Figure 8. Average Torque Versus Frequency of Occurrence at 20- to 30-Percent Torque Split (26 Sample Points, Table I Data).

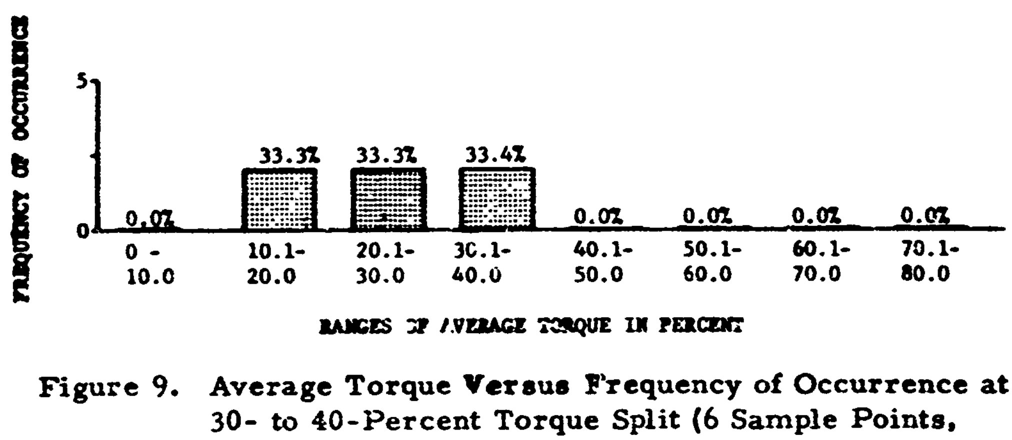

Figure 9. Average Torque Versus Frequency of Occurrence at 30- to 40-Percent Torque Split (6 Sample Points, Table I Data).

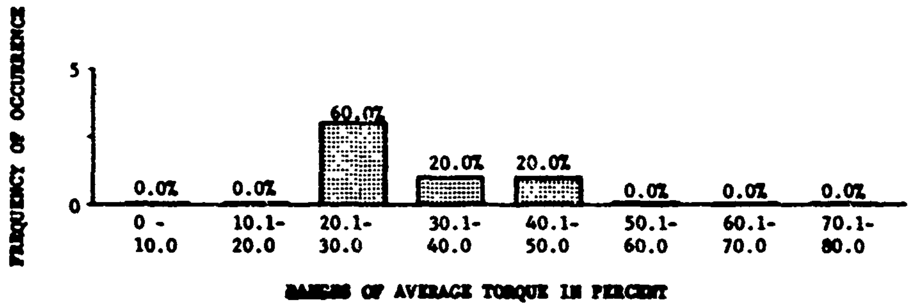

Figure 10. Average Torque Versus Frequency of Occurrence at 40- to 50-Percent Torque Split (5 Sample Points, Table I Data).

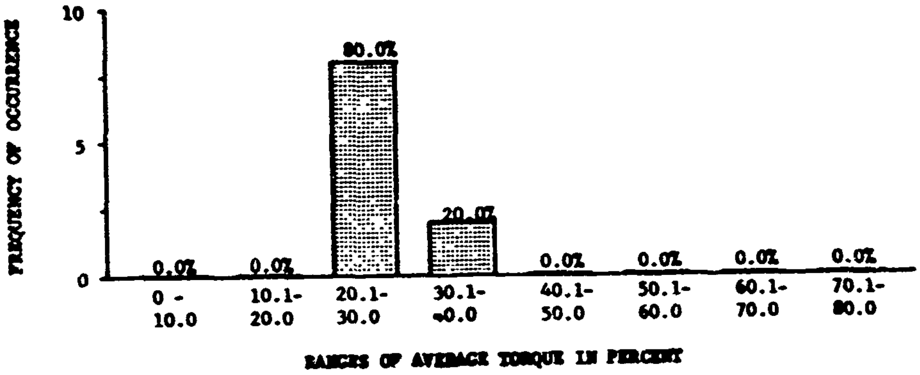

Figure 11. Average Torque Versus Frequency of Occurrence at 50- to 60-Percent Torque Split (10 Sample Points, Table I Data).

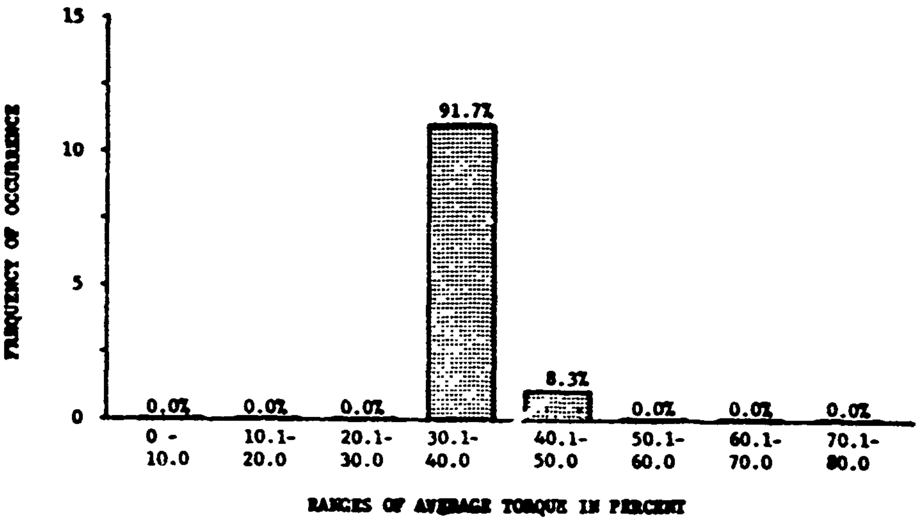

Figure 12. Average Torque Versus Frequency of Occurrence at 60- to 70-Percent Torque Split (12 Sample Points, Table I Data).

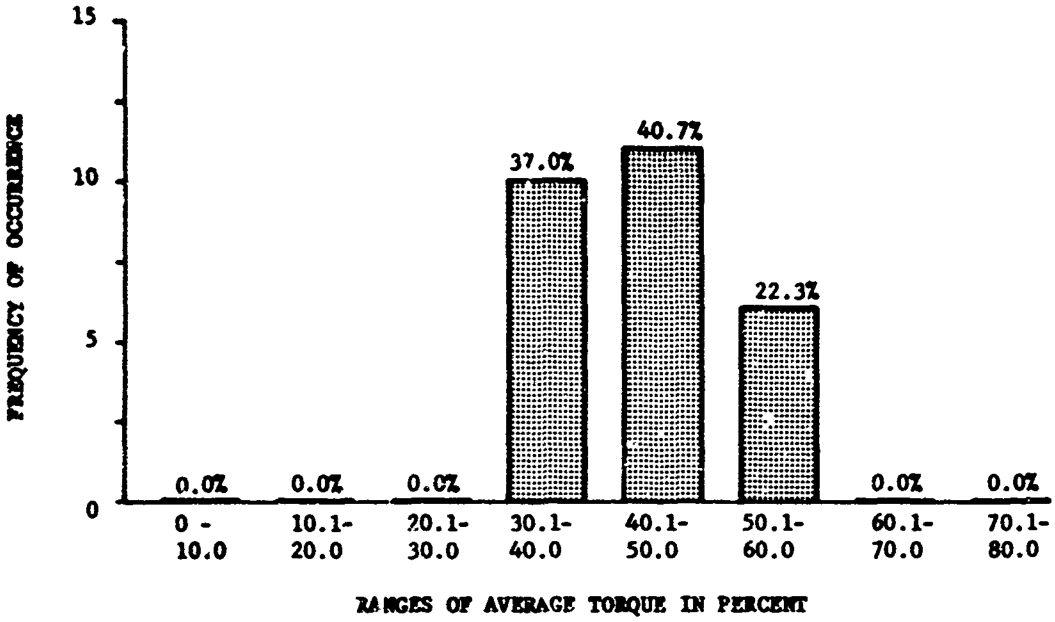

Figure 13. Average Torque Versus Frequency of Occurrence at 70- to 100-Percent Torque Split (27 Sample Points, Table I Data).

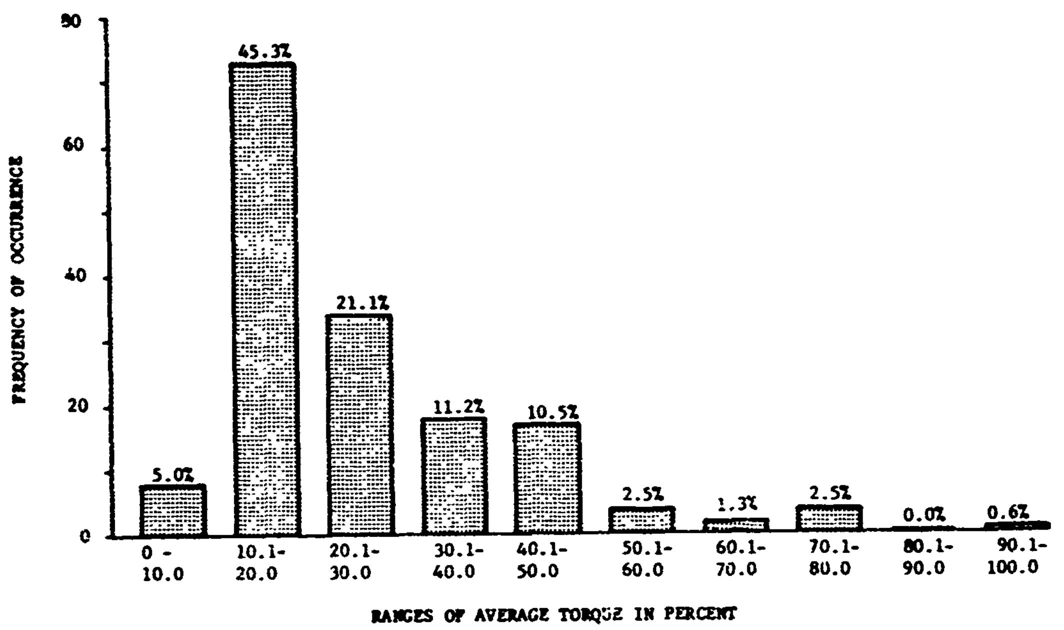

Figure 14. Average Torque Versus Frequency of Occurrence During Descent Operations With Torque Split Greater Than 10 Percent (161 Sample Points, Table I Data).

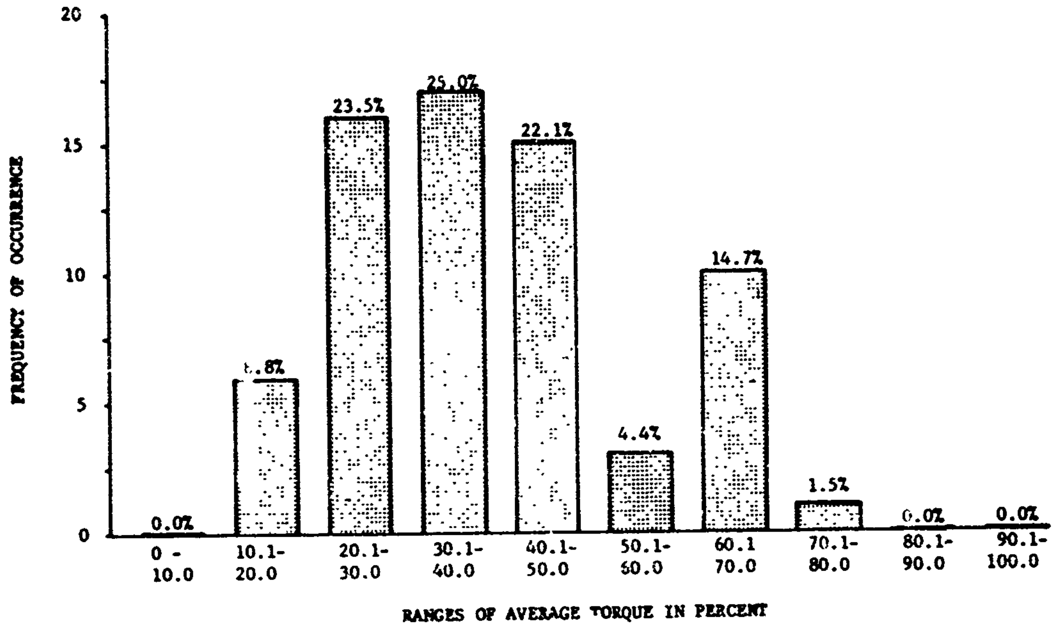

Figure 15. Average Torque Versus Frequency of Occurrence During Steady Operations With Torque Split Greater Than 10 Percent (68 Sample Points, Table I Data).

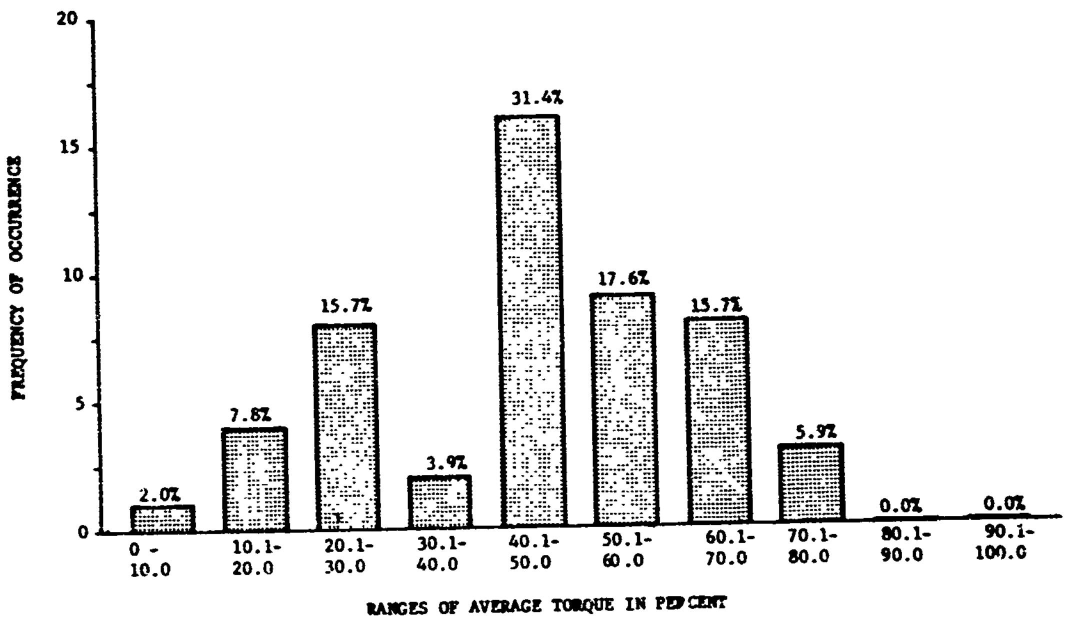

Figure 16. Average Torque Versus Frequency of Occurrence During Ascent, Hover, and Maneuver Operations With Torque Split Greater Than 10 Percent (51 Sample Points, Table I Data).

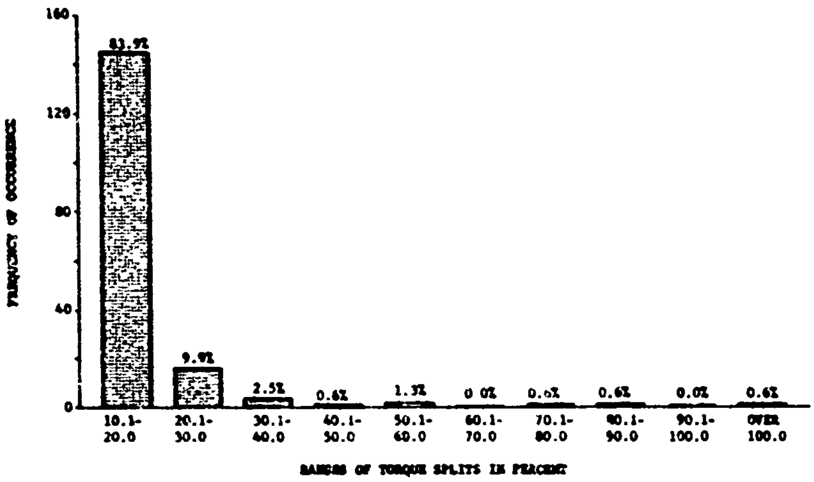

Figure 17. Toıque Splits Versus Frequency of Occurrence During Descent Operations With Torque Split Greater Than 10 Percent (161 Sample Points, Table I Data).

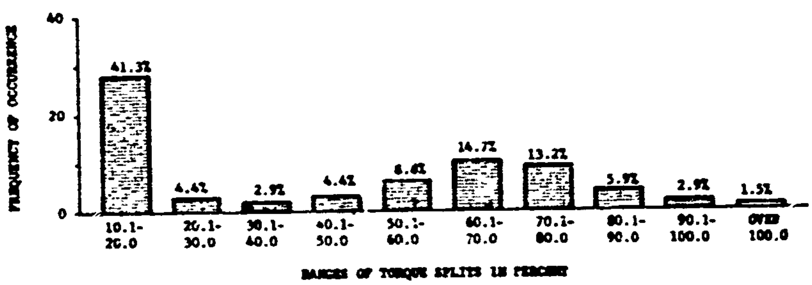

Figure 18. Torque Splits Versus Frequency of Occurrence During Descent Operations With Torque Split Greater Than 10 Percent (68 Sample Points, Table I Data).

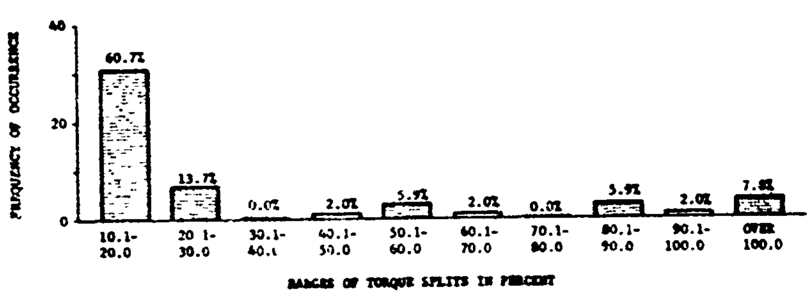

Figure 19. Torque Splits Versus Frequency of Occurrence During Ascent, Hover, and Maneuver Operations With Torque Split Greater Than 10 Percent (51 Sample Points, Table I Data).

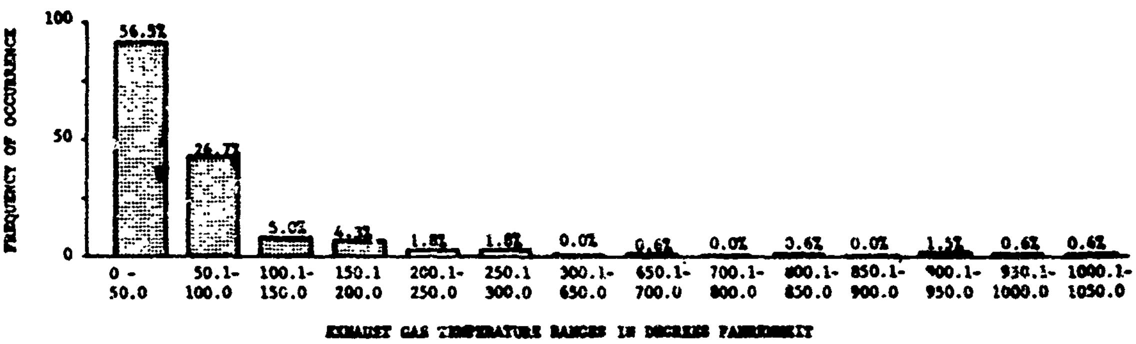

Figure 20. Exhaust Gas Temperature Splits Versus Frequency of Occurrence During Descent Operations With Torque Split Greater Than 10 Percent (161 Sample Points, Table I Data).

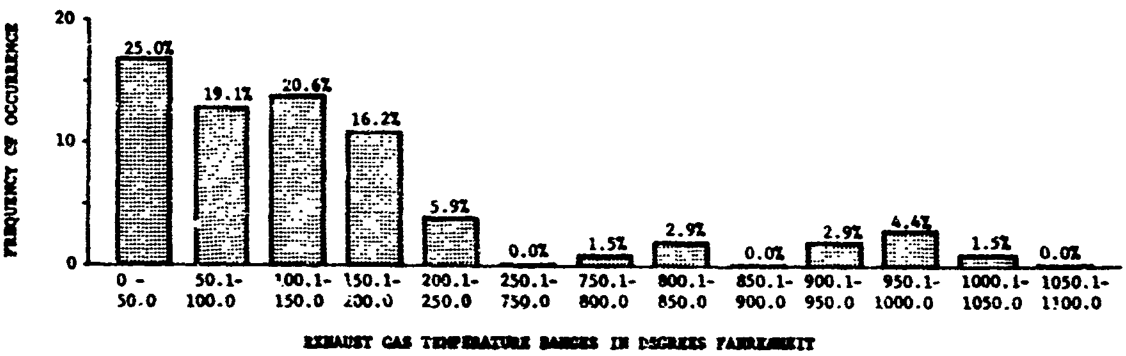

Figure 21. Exhaust Gas Temperature Splits Versus Frequency of Occurrence During Steady Operations With Torque Split Greater Than 10 Percent (68 Sample Points, Table I Data).

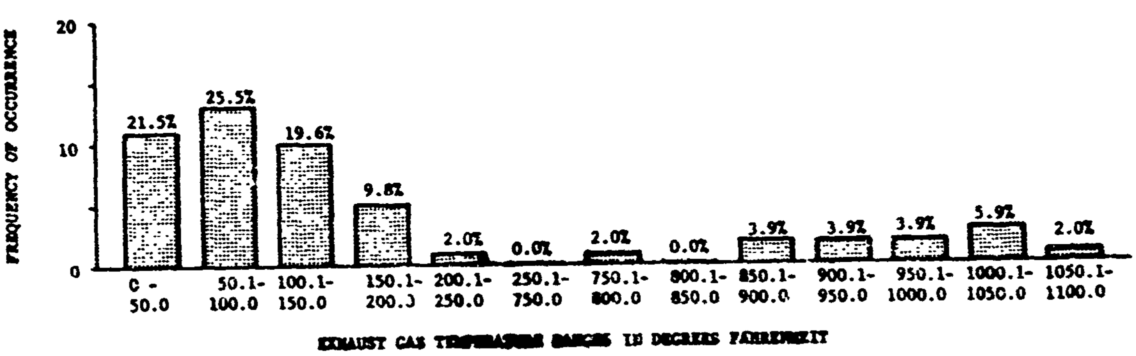

Figure 22. Exhaust Gas Temperature Splits Versus Frequency of Occurrence During Ascent, Hover, and Maneuver Operations With Torque Split Greater Than 10 Percent (51 Sample Points, Table I Data).

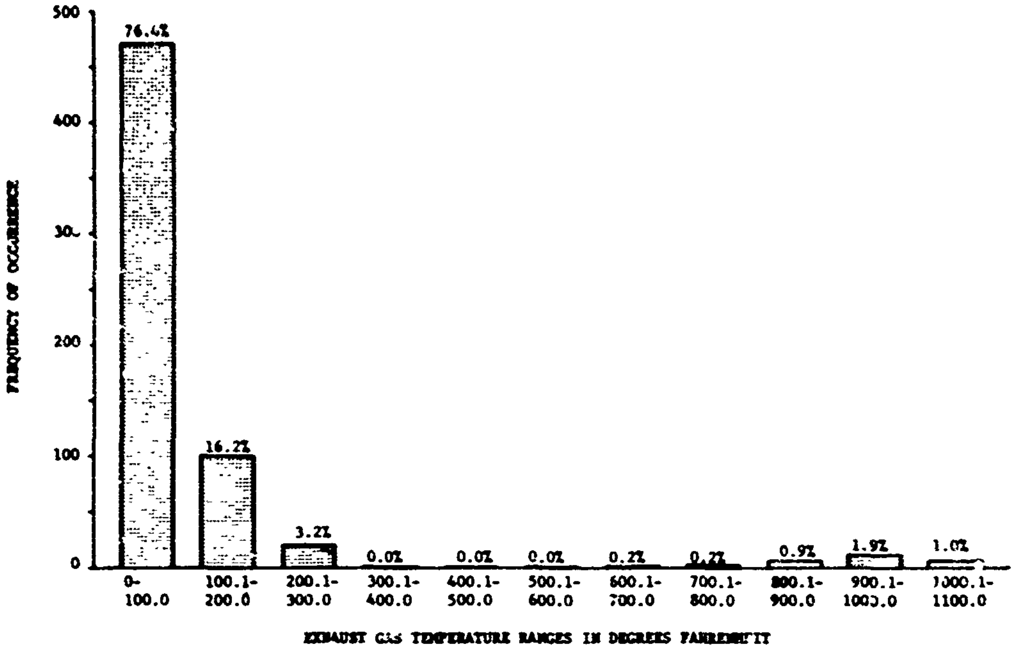

Figure 23. Summary: Exhaust Gas Temperature Splits Versus Frequency of Occurrence (618 Sample Points, Table I Data).

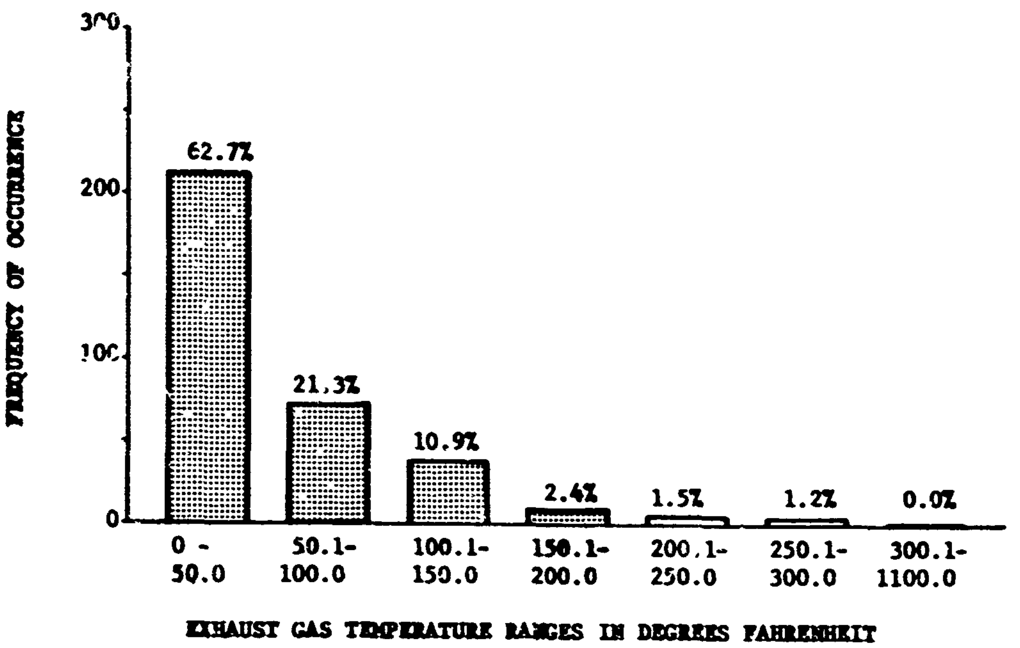

Figure 24. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 0- to 10-Percent Torque Split (338 Sample Points, Table I Data).

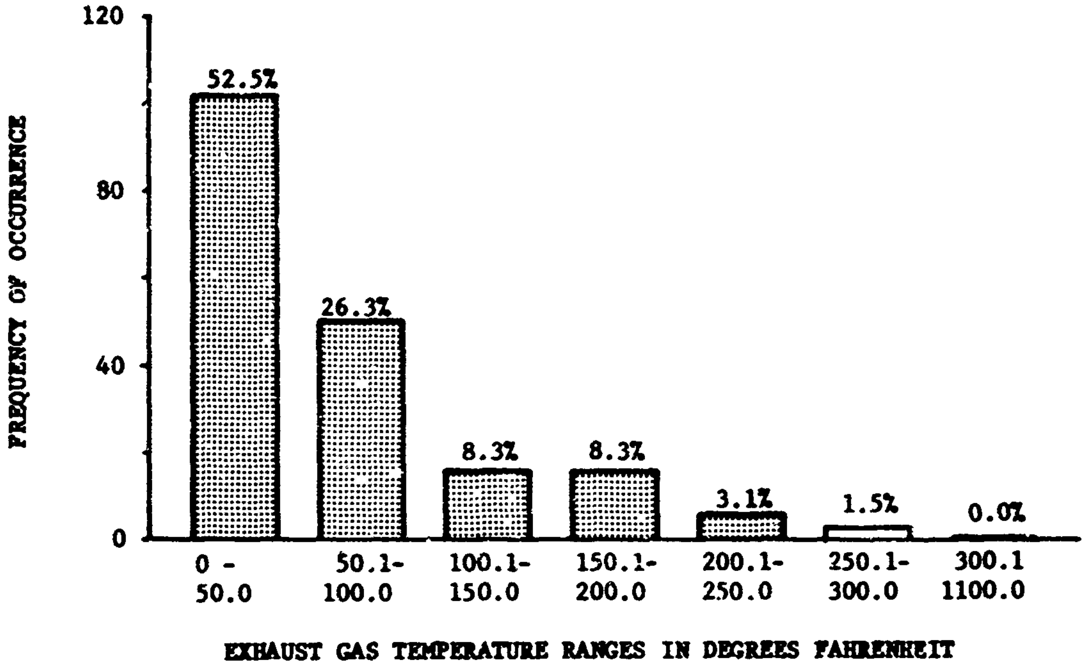

Figure 25. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 10- to 20-Percent Torque Split (194 Sample Points, Table I Data).

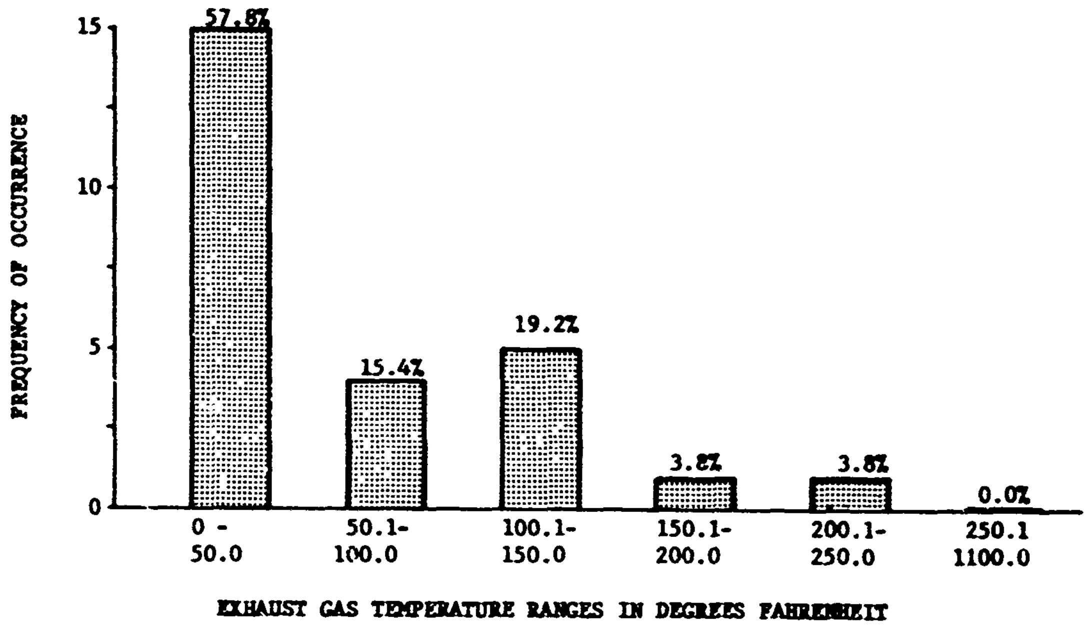

Figure 26. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 20- to 30-Percent Torque Split (26 Sample Points, Table I Data).

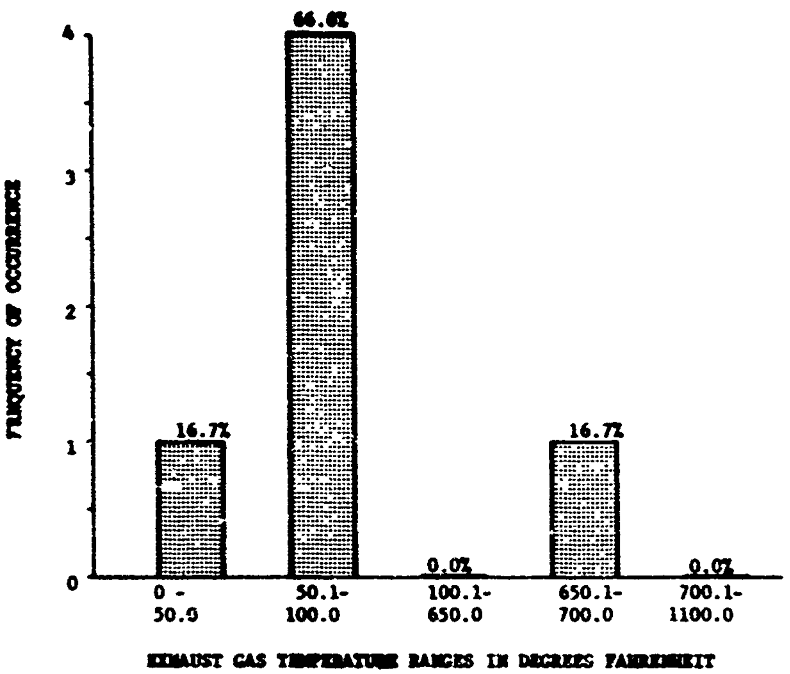

Figure 27. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 30- to 40-Percent Torque Split (6 Sample Points, Table I Data).

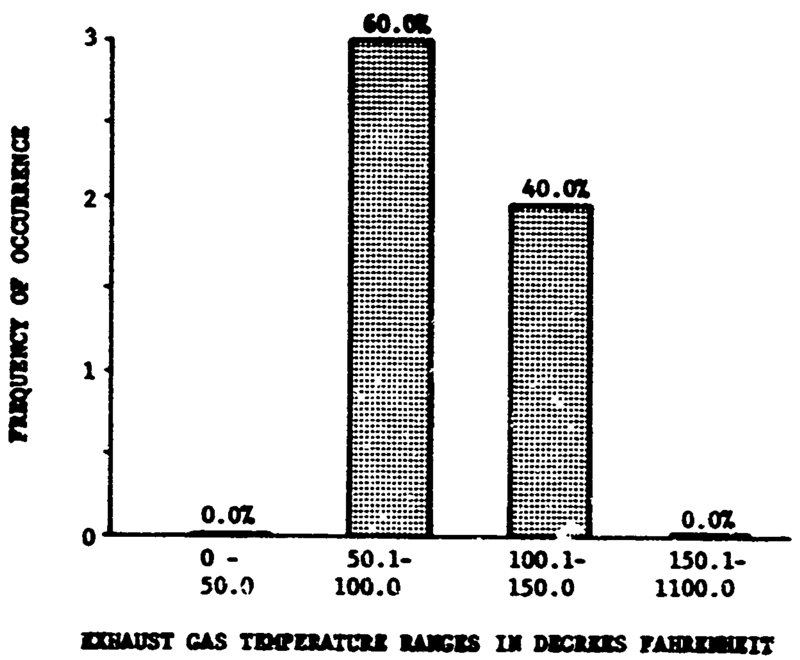

Figure 28. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 40- to 50-Percent Torque Split (5 Sample Points, Table I Data).

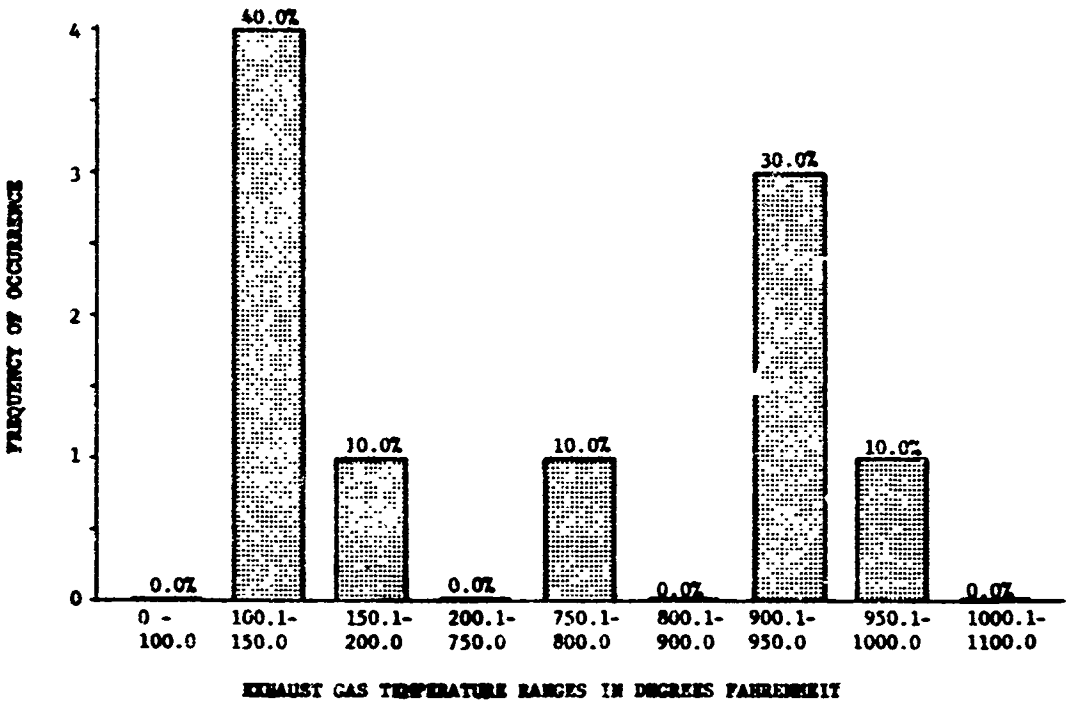

Figure 29. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 50- to 60-Percent Torque Split (10 Sample Points, Table I Data).

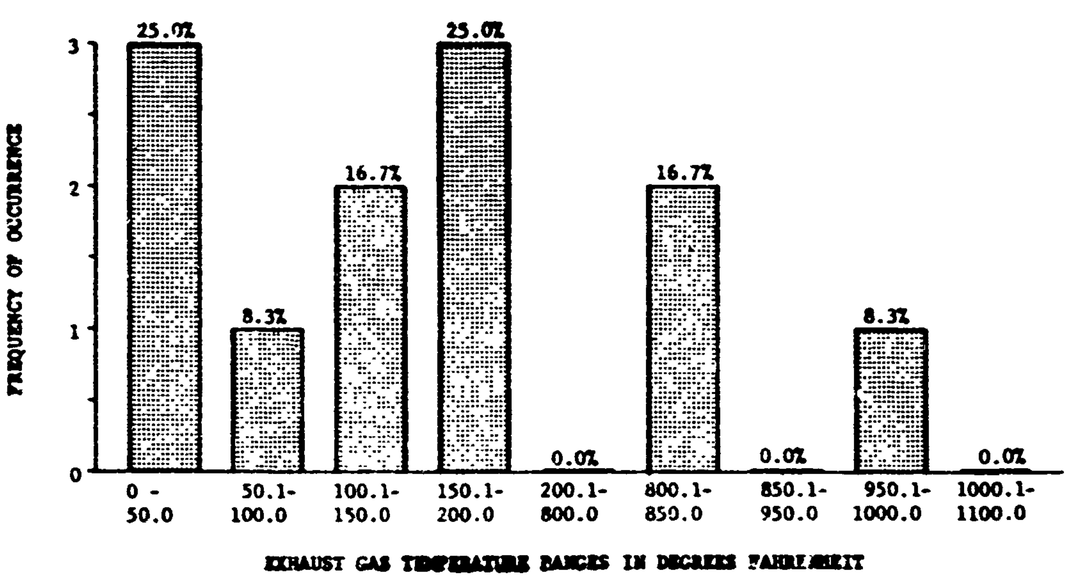

Figure 30. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 60- to 70-Percent Torque Split (12 Sample Points, Table I Data).

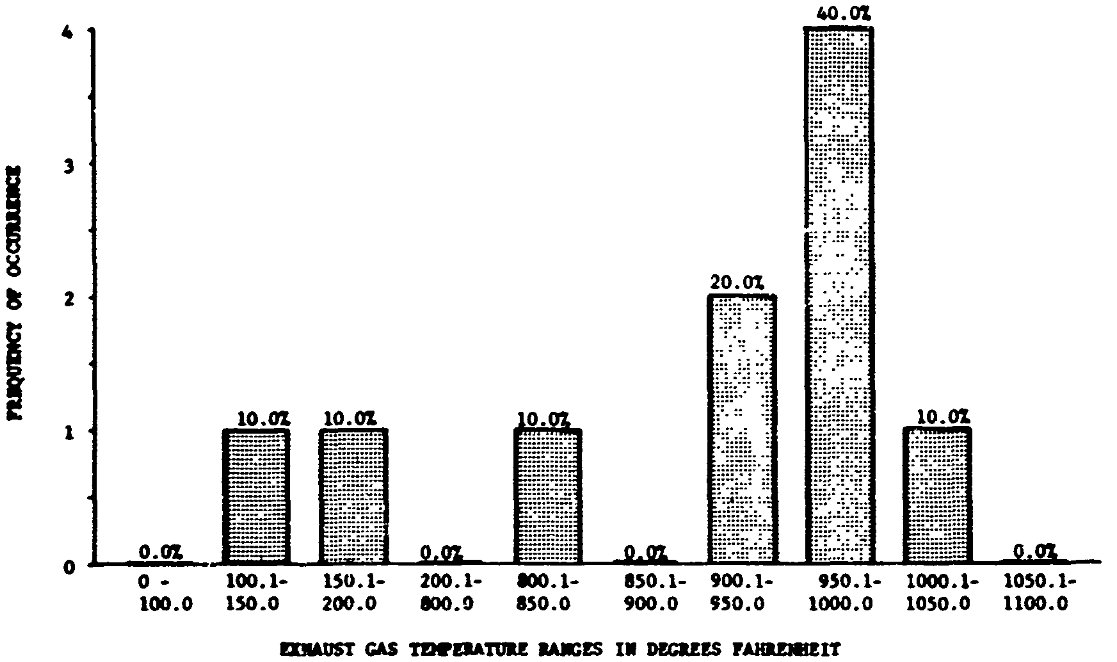

Figure 31. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 70- to 80-Percent Torque Split (10 Sample Points, Table I Data).

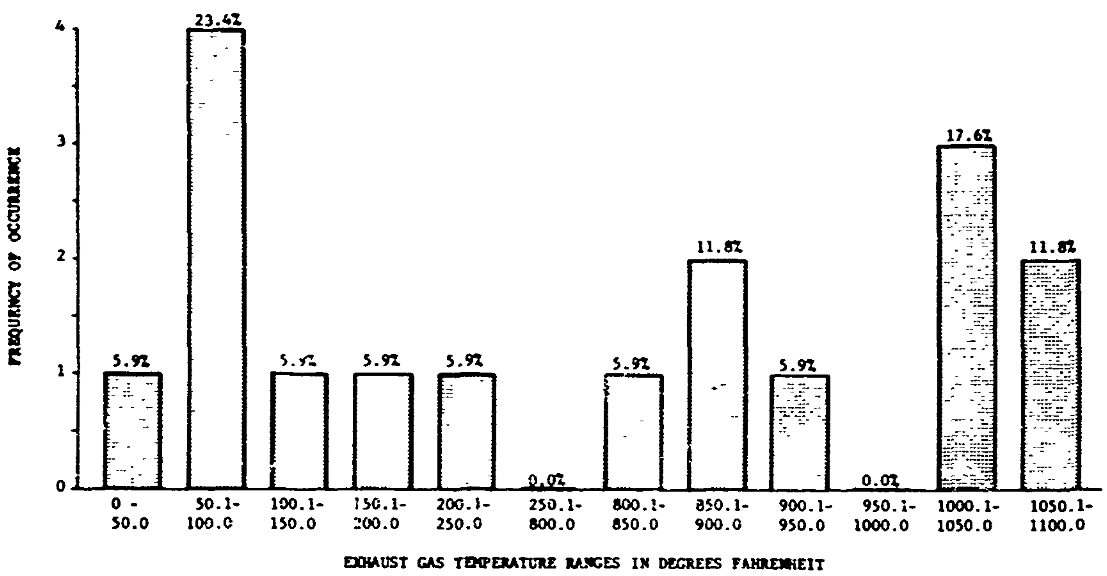

Figure 32. Exhaust Gas Temperature Splits Versus Frequency of Occurrence at 80- to 100-Percent Torque Split (17 Sample Points, Table I Data).

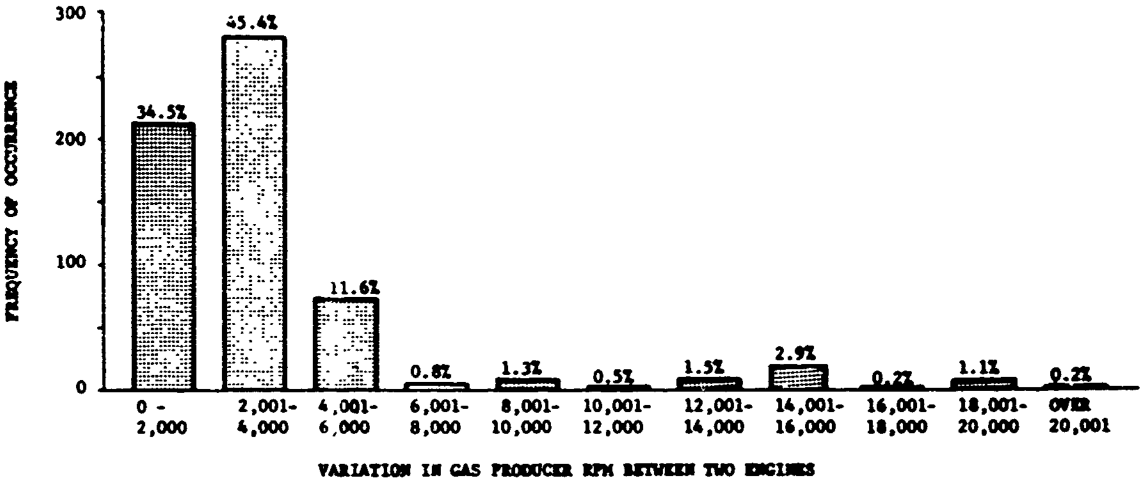

Figure 33. Summary: Gas Producer RPM Splits Versus Frequency of Occurrence (618 Sample Points, Table I Data).

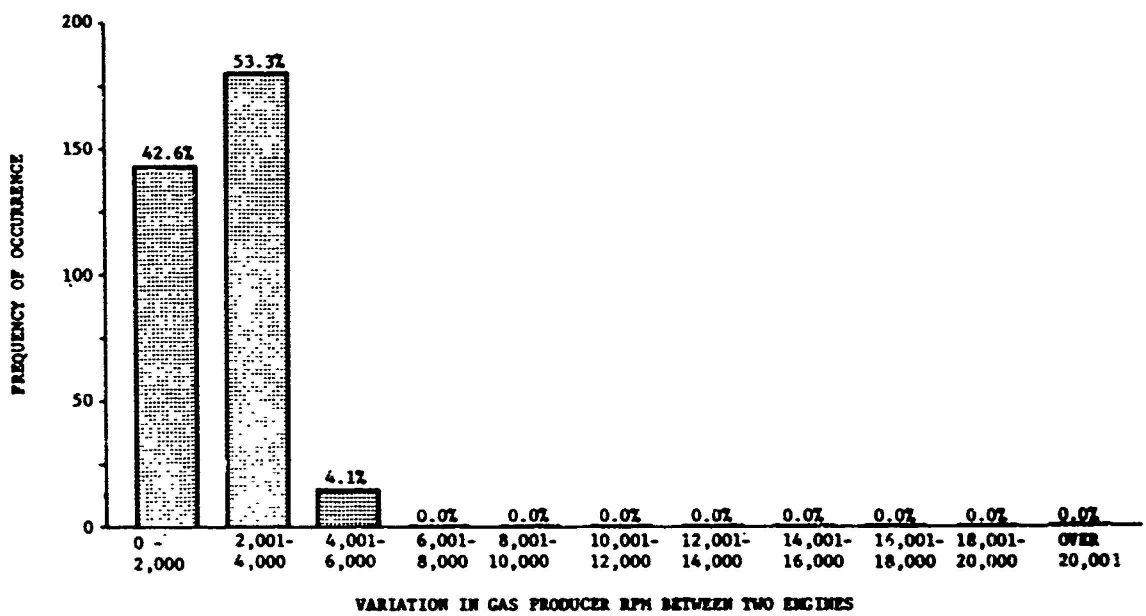

Figure 34. Gas Producer RPM Splits Versus Frequency of Occurrence at 0- to 10-Percent Torque Split (338 Sample Points, Table I Data).

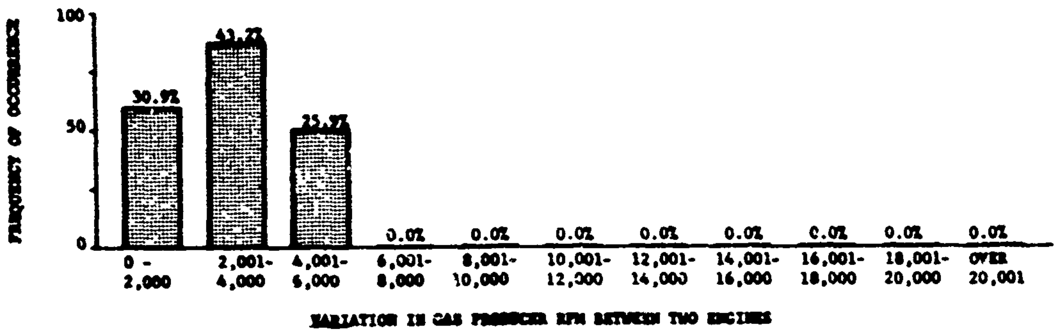

Figure 35. Gas Producer RPM Splits Versus Frequency of Occurrence at 10- to 20-Percent Torque Split (194 Sample Points, Table I Data).

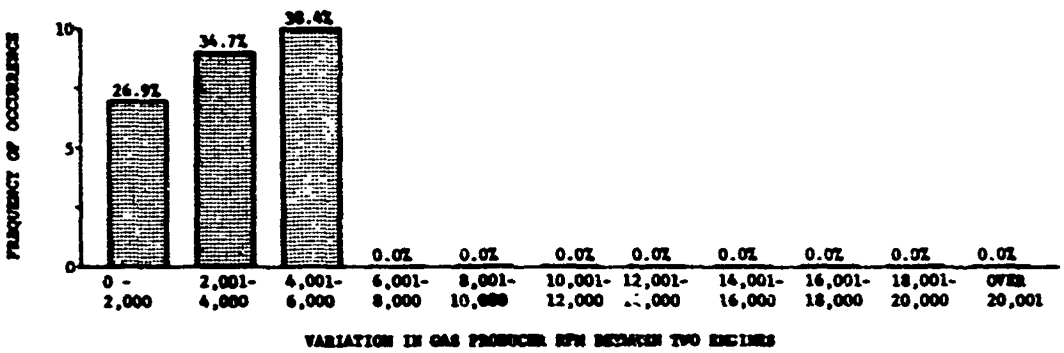

Figure 36. Gas Producer RPM Splits Versus Frequency of Occurrence at 20- to 30-Percent Torque Split (27 Sample Points, Table I Data).

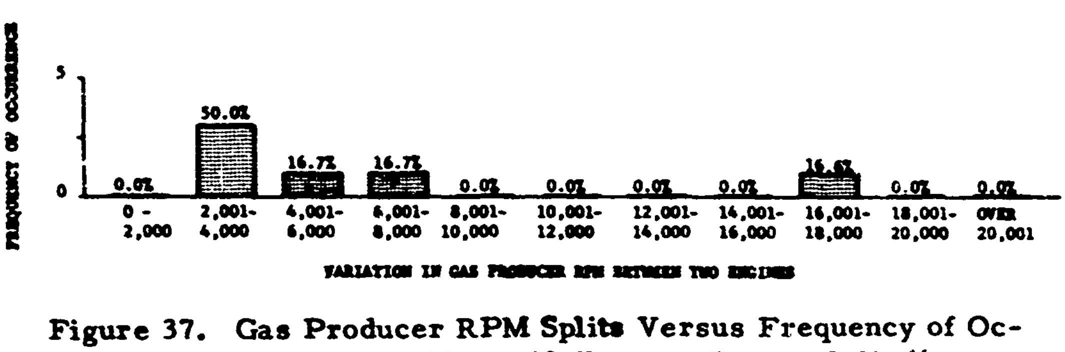

Figure 37. Gas Producer RPM Splits Versus Frequency of Occurrence at 30- to 40-Percent Torque Split (6 Sample Points, Table I Data).

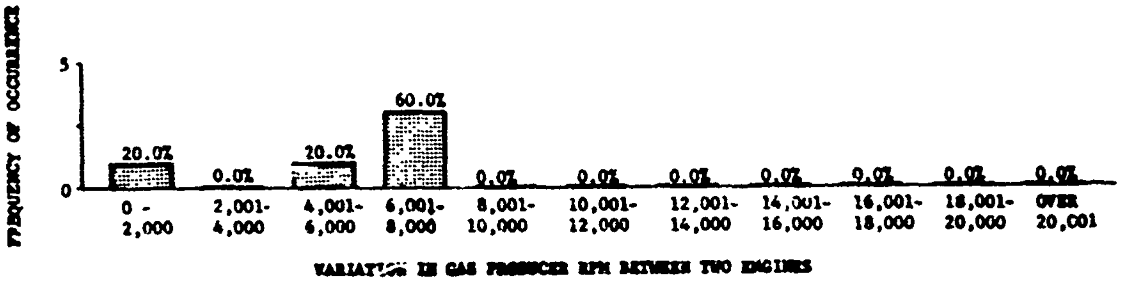

Figure 38. Gas Producer RPM Splits Versus Frequency of Occurrence at 40- to 50-Percent Torque Split (5 Sample Points, Table I Data).

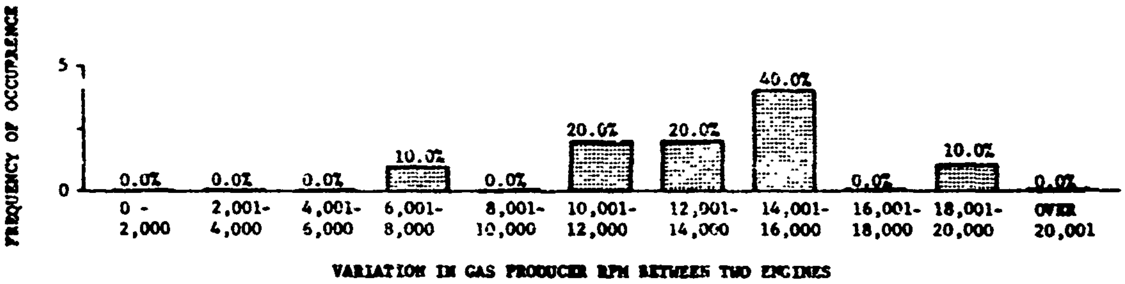

Figure 39. Gas Producer RPM Splits Versus Frequency of Occurrence at 50- to 60-Percent Torque Split (10 Sample Points, Table I Data).

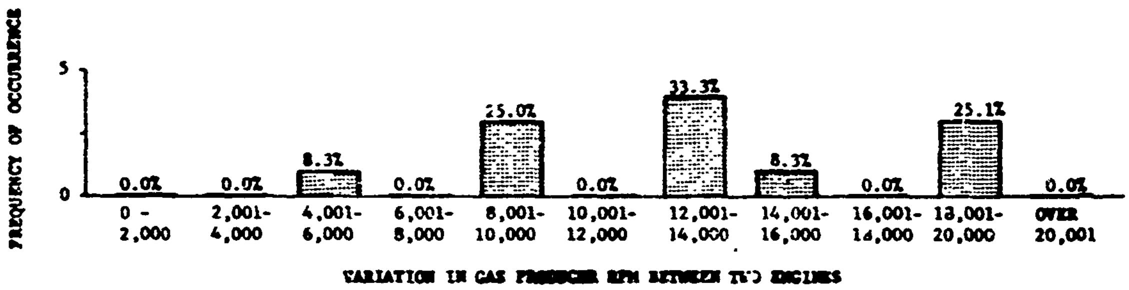

Figure 40. Gas Producer RPM Splits Versus Frequency of Occurrence at 60- to 70-Percent Torque Split (12 Sample Points, Table I Data).

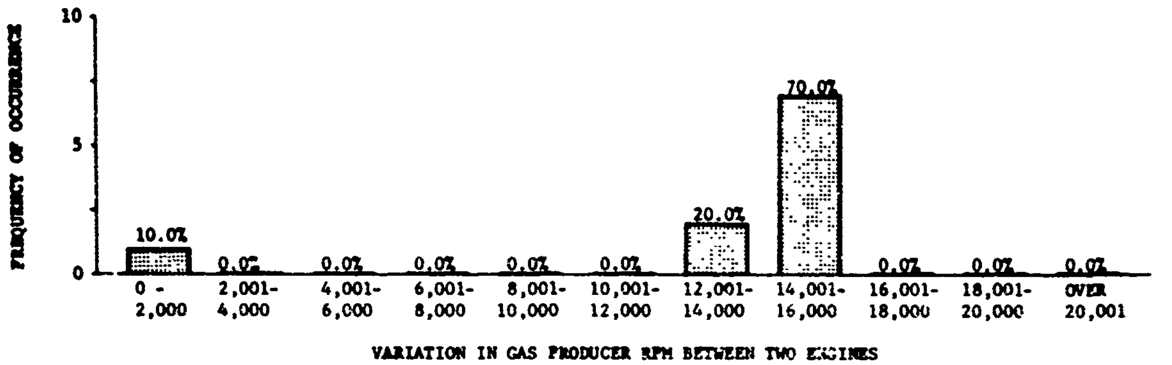

Figure 41. Gas Producer RPM Splits Versus Frequency of Occurrence at 70- to 80-Percent Torque Split (10 Sample Points, Table I Data).

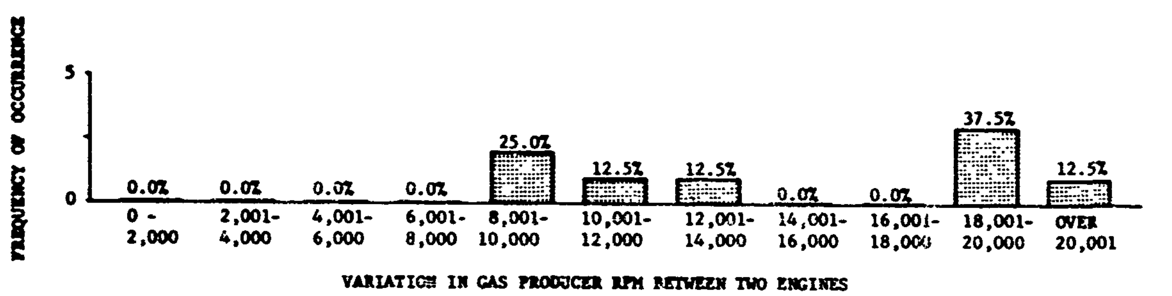

Figure 42. Gas Producer RPM Splits Versus Frequency of Occurrence at 80- to 90-Percent Torque Split (8 Sample Points, Table I Data).

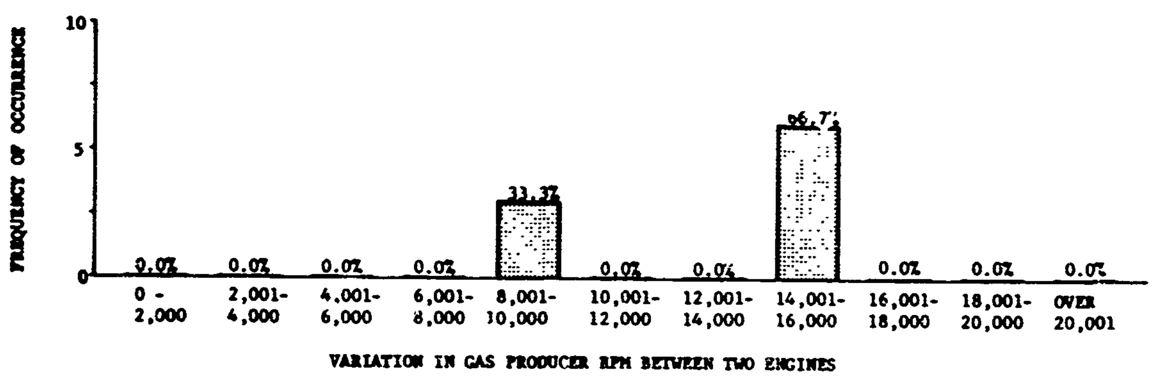

Figure 43. Gas Producer RPM Splits Versus Frequency of Occurrence at 90- to 100-Percent Torque Split (9 Sample Points, Table I Data).

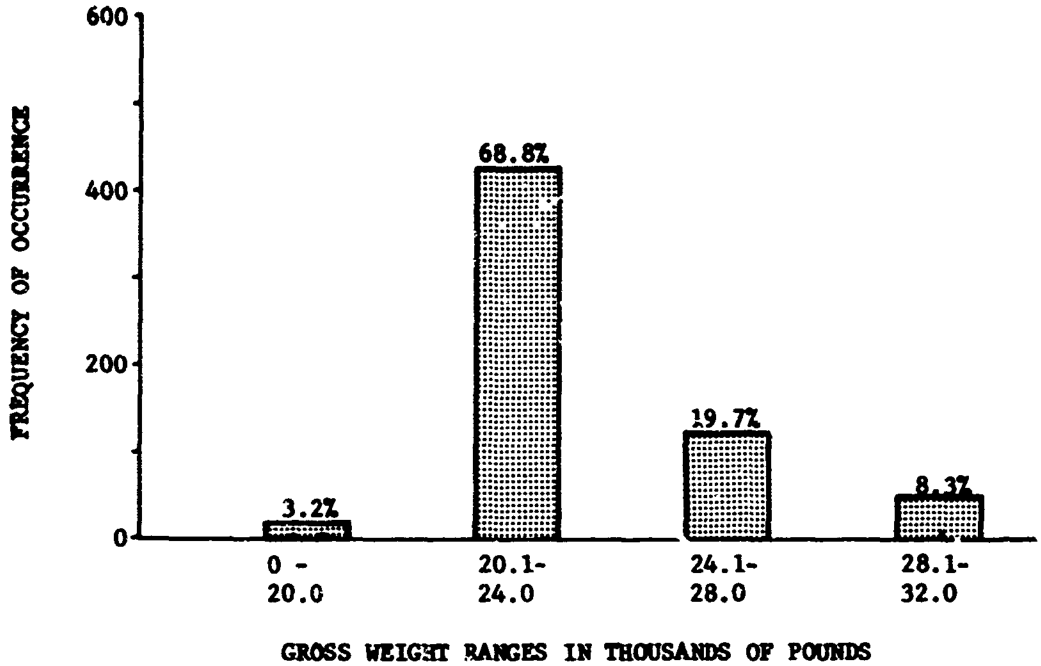

Figure 44. Summary: Gross Weight Versus Frequency of Occurrence (618 Sample Points, Table I Data).

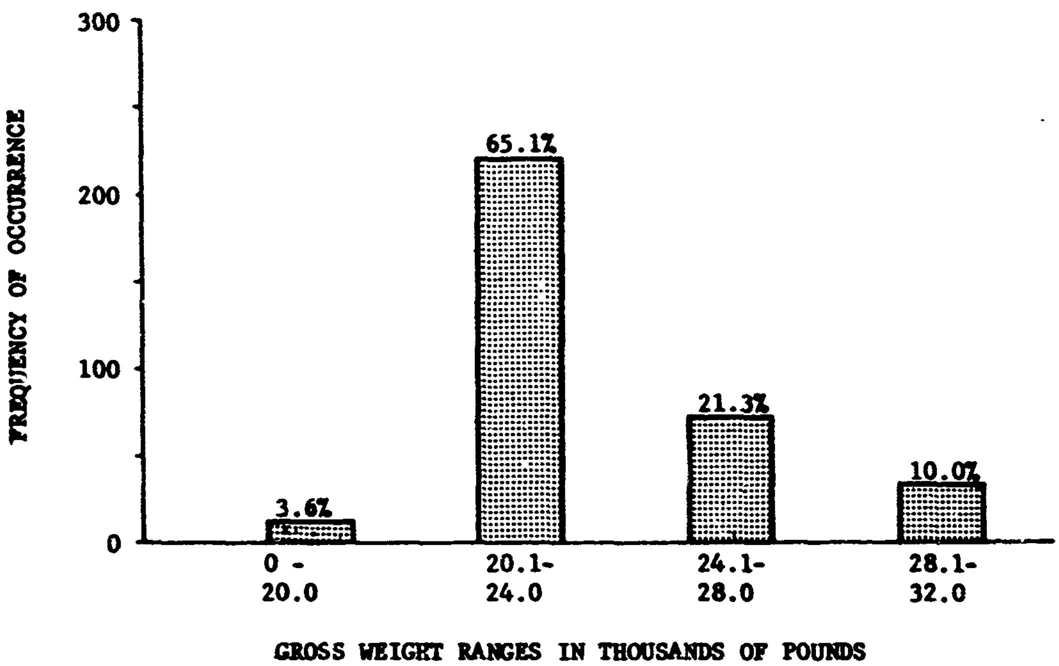

Figure 45. Gross Weight Versus Frequency of Occurrence at 0- to 10-Percent Torque Split (338 Sample Points, Table I Data).

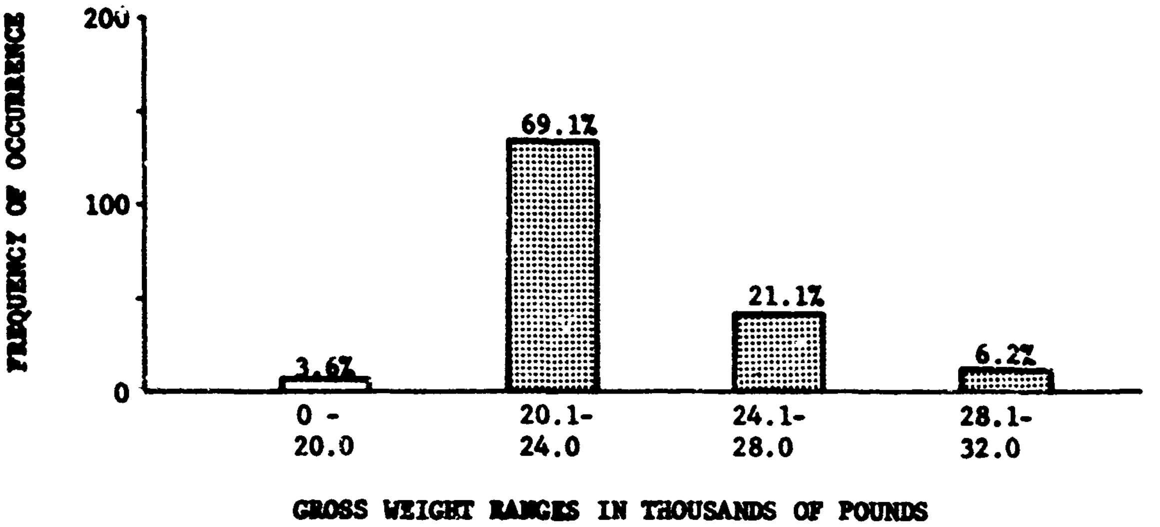

Figure 46. Gross Weight Versus Frequency of Occurrence at 10- to 20-Percent Torque Split (194 Sample Points, Table I Data).

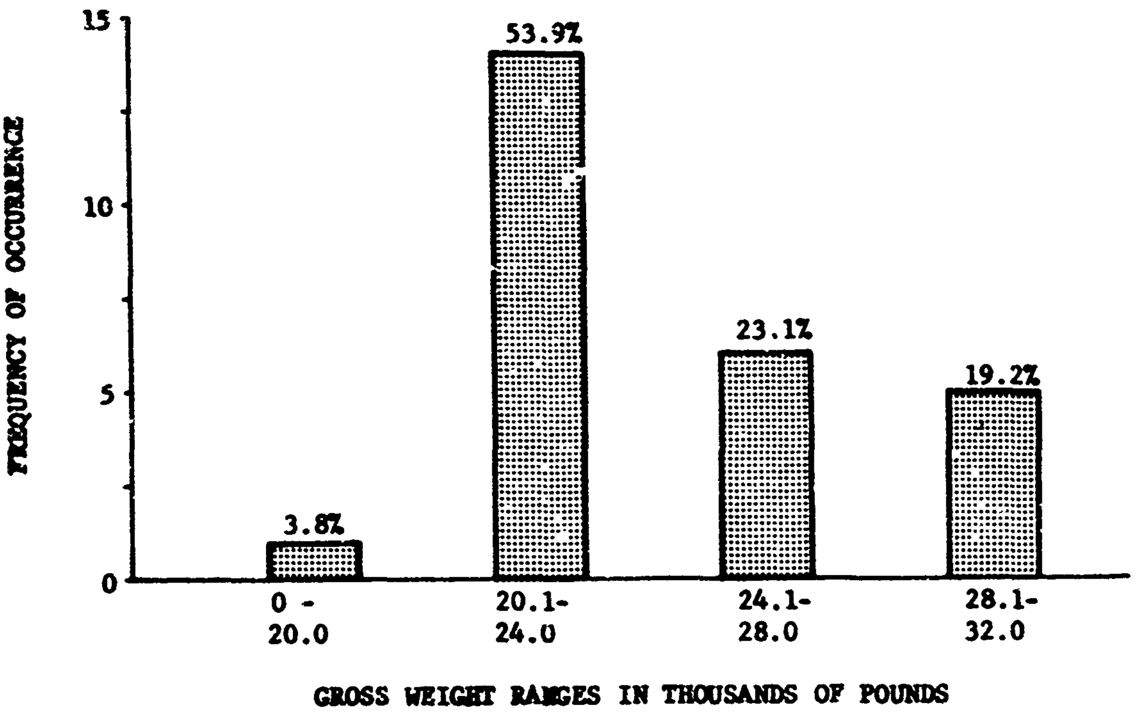

Figure 47. Gross Weight Versus Frequency of Occurrence at 20- to 30-Percent Torque Split (26 Sample Points, Table I Data).

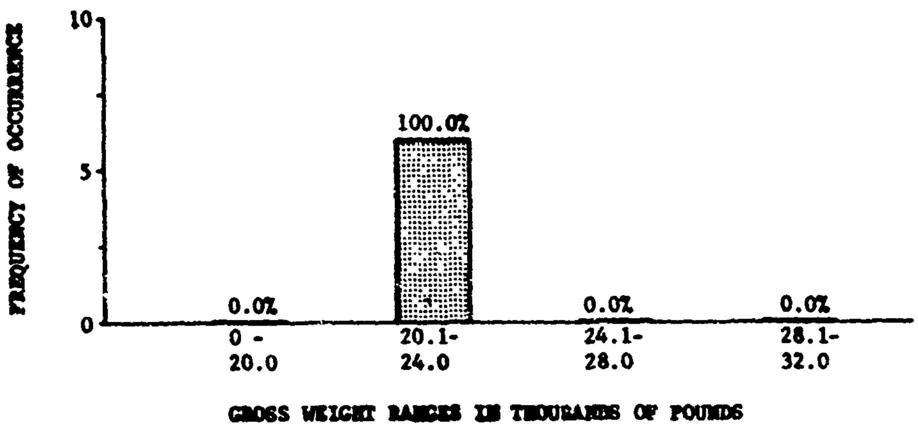

Figure 48. Gross Weight Versus Frequency of Occurrence at 30- to 40-Percent Torque Split (6 Sample Points, Table I Data).

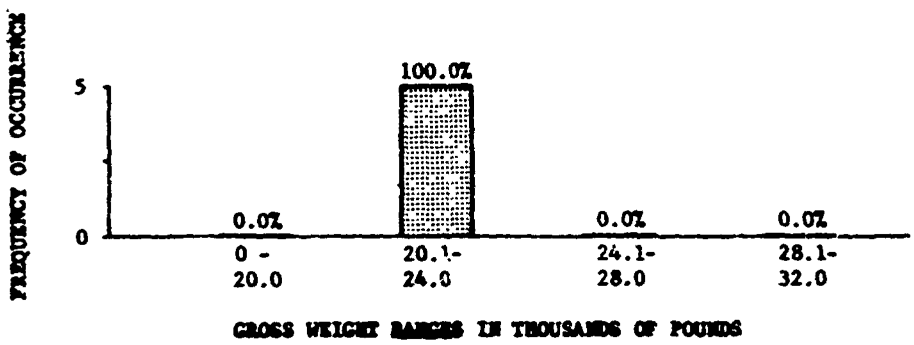

Figure 49. Gross Weight Versus Frequency of Occurrence at 40- to 50-Percent Torque Split (5 Sample Points, Table I Data).

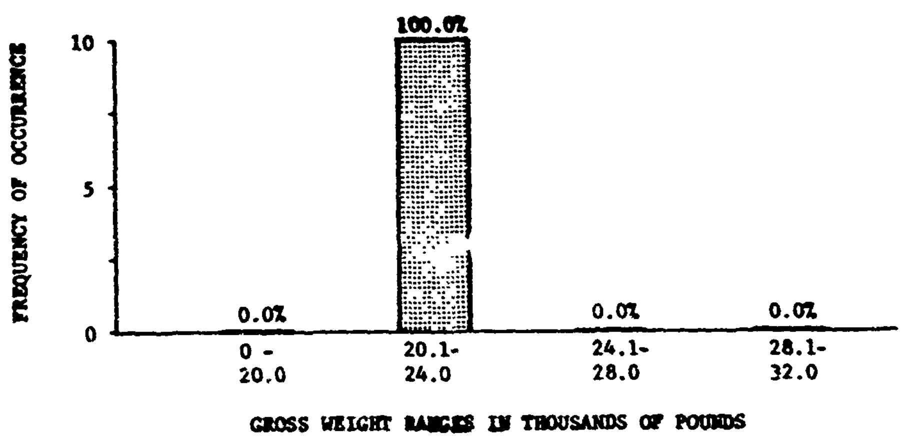

Figure 50. Gross Weight Versus Frequency of Occurrence at 50- to 60-Percent Torque Split (10 Sample Points, Table I Data).

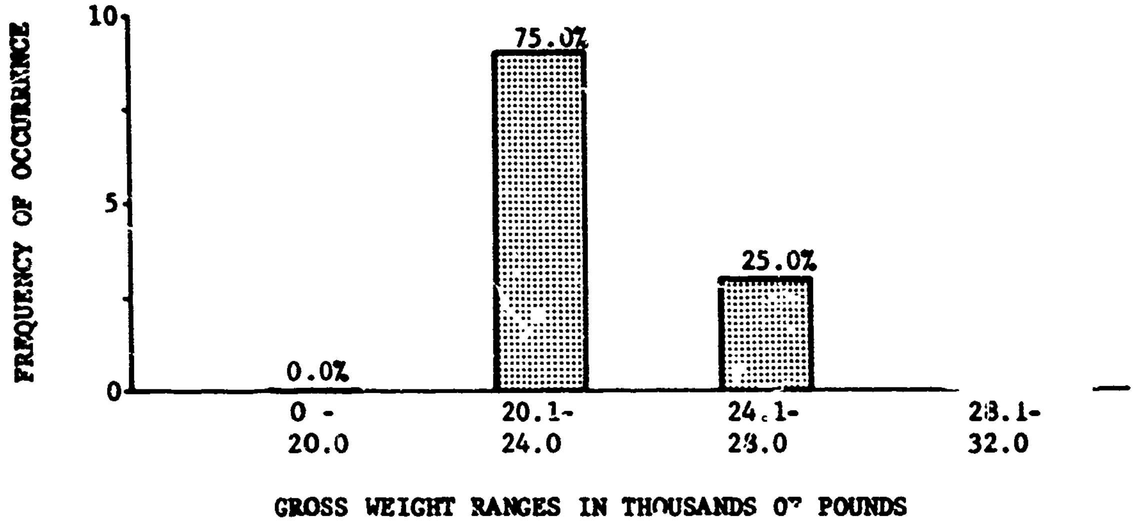

Figure 51. Gross Weight Versus Frequency of Occurrence at 60- to 70-Percent Torque Split (12 Sample Points, Table I Data).

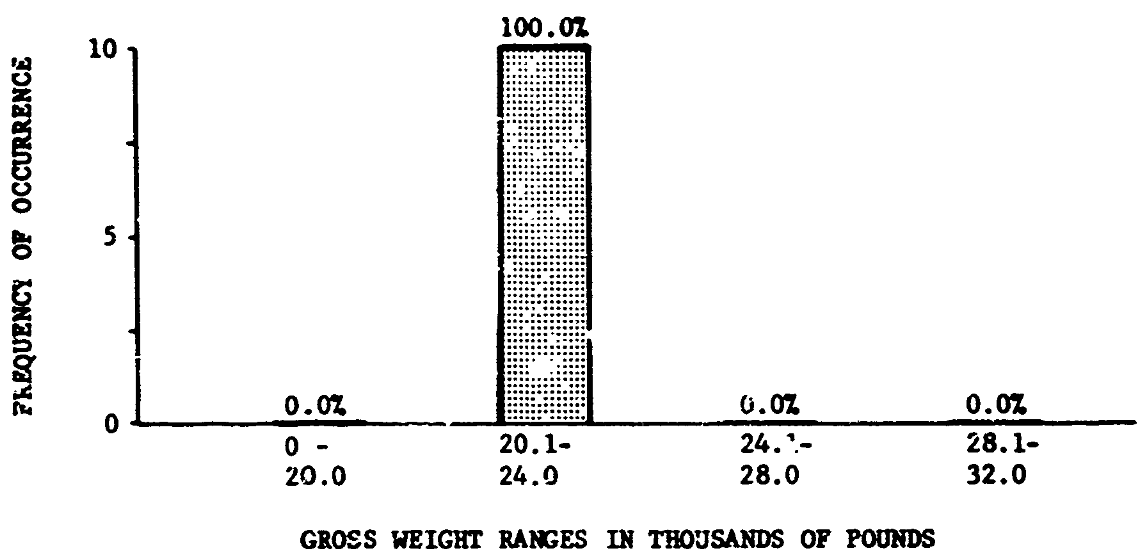

Figure 52. Gross Weight Versus Frequency of Occurrence at 70- to 80-Percent Torque Split (10 Sample Points, Table I Data).

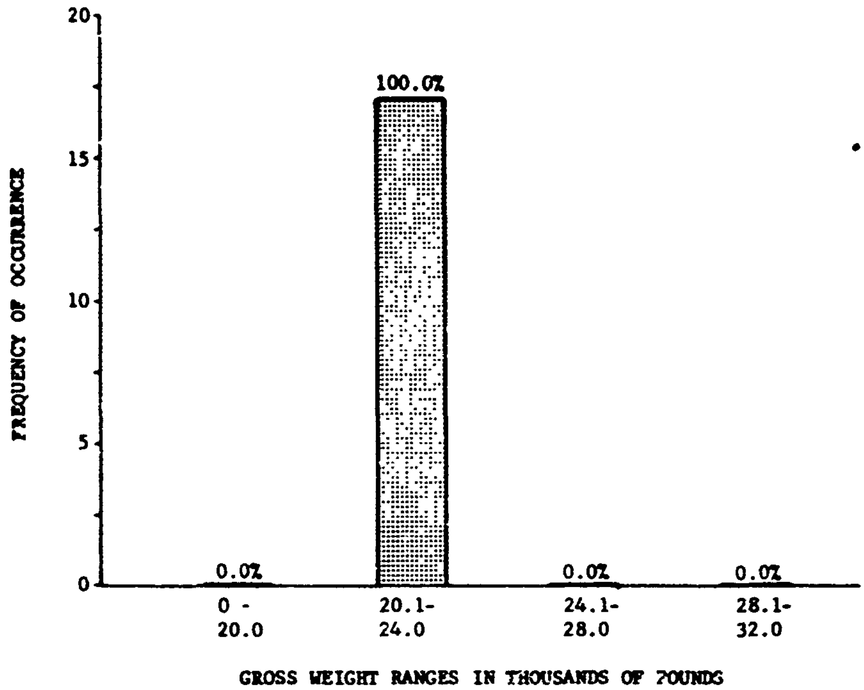

Figure 53. Gross Weight Versus Frequency of Occurrence at 80- to 100-Percent Torque Split (17 Sample Points, Table I Data).

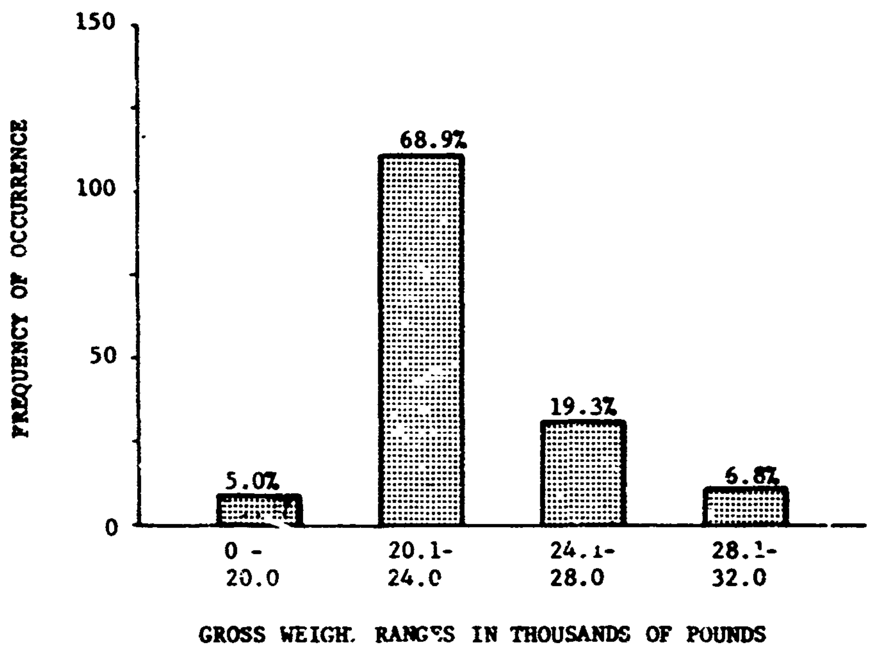

Figure 54. Gross Weight Versus Frequency of Occurrence During Descent Operations With Torque Split Greater Than 10 Percent (161 Sample Points, Table I Data).

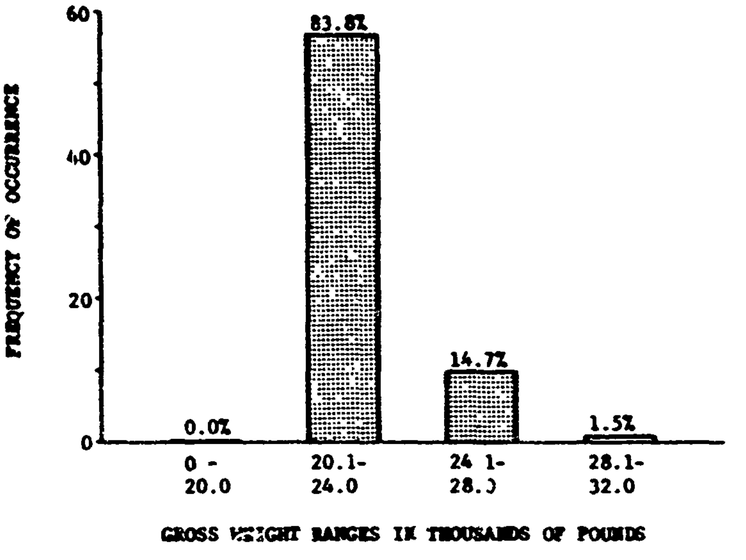

Figure 55. Gross Weight Versus Frequency of Occurrence During Steady Operations With Torque Split Greater Than 10 Percent (68 Sample Points, Table I Data).

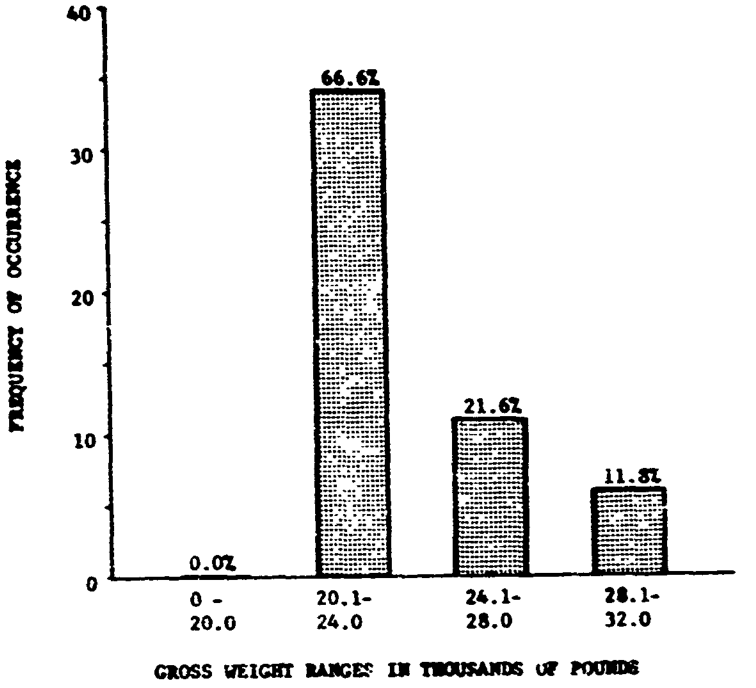

Figure 56. Gross Weight Versus Frequency of Occurrence During Ascent, Hover, and Maneuver Operations With Torque Split Greater Than 10 Percent (51 Sample Points, Table I Data).

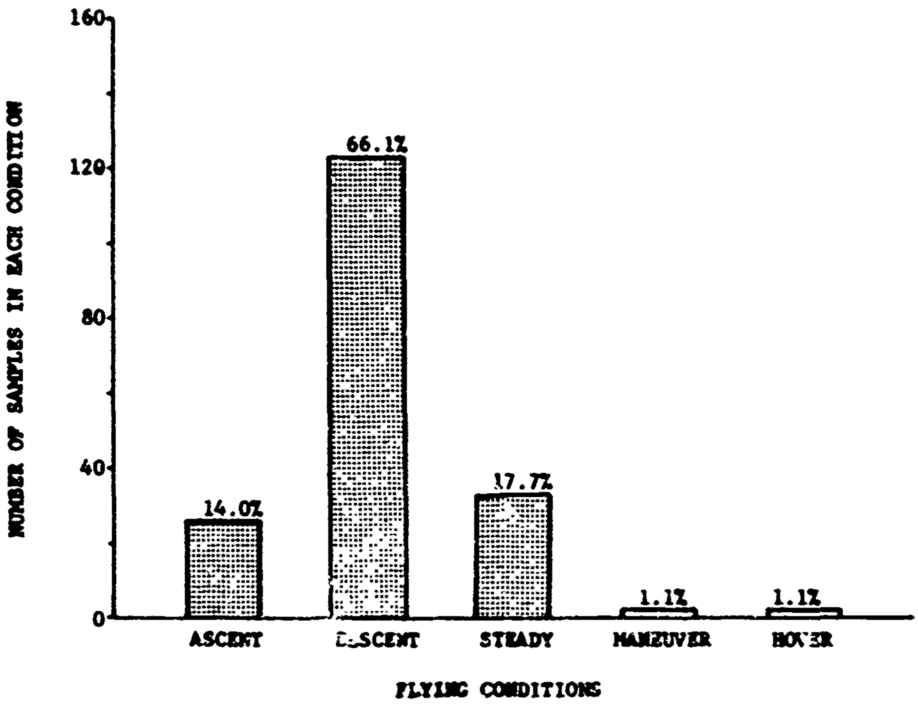

Figure 57. Summary: Percentage of Samples in Various Flight Modes During Torque Splits (618 Sample Points, Table I Data).

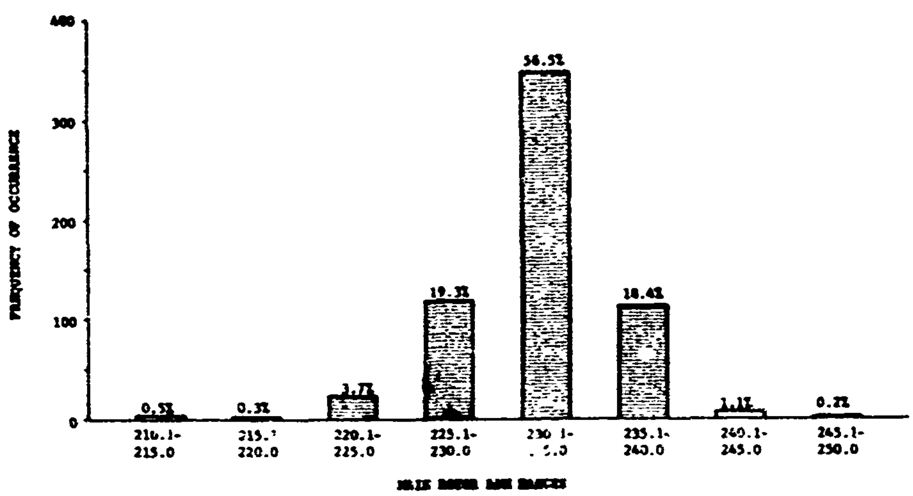

Figure 58. Summary: Main Rotor RPM Versus Frequency of Occurrence (618 Sample Points, Table I Data).

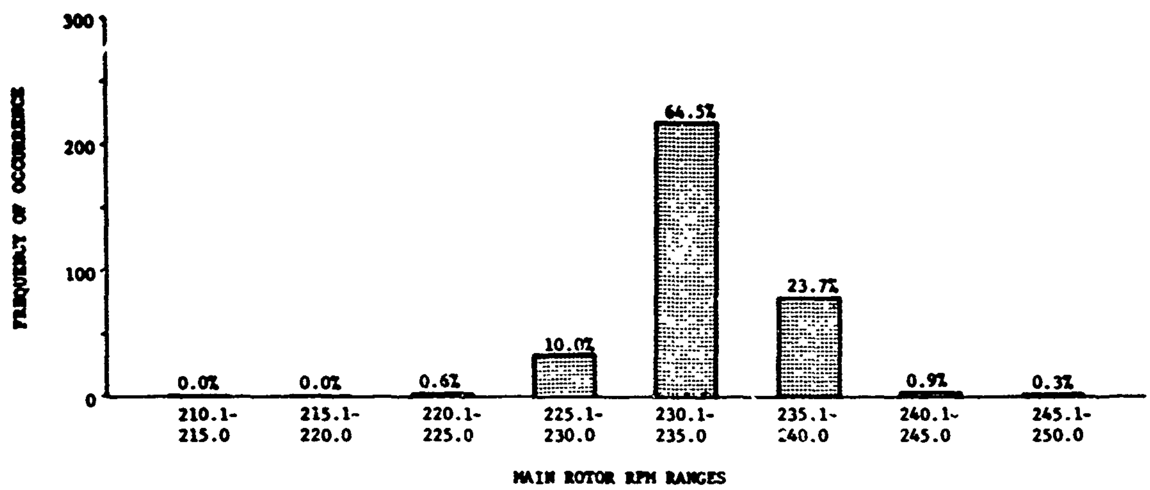

Figure 59. Main Rotor RPM Versus Frequency of Occurrence at 0- to 10-Percent Torque Split (338 Sample Points, Table I Data).

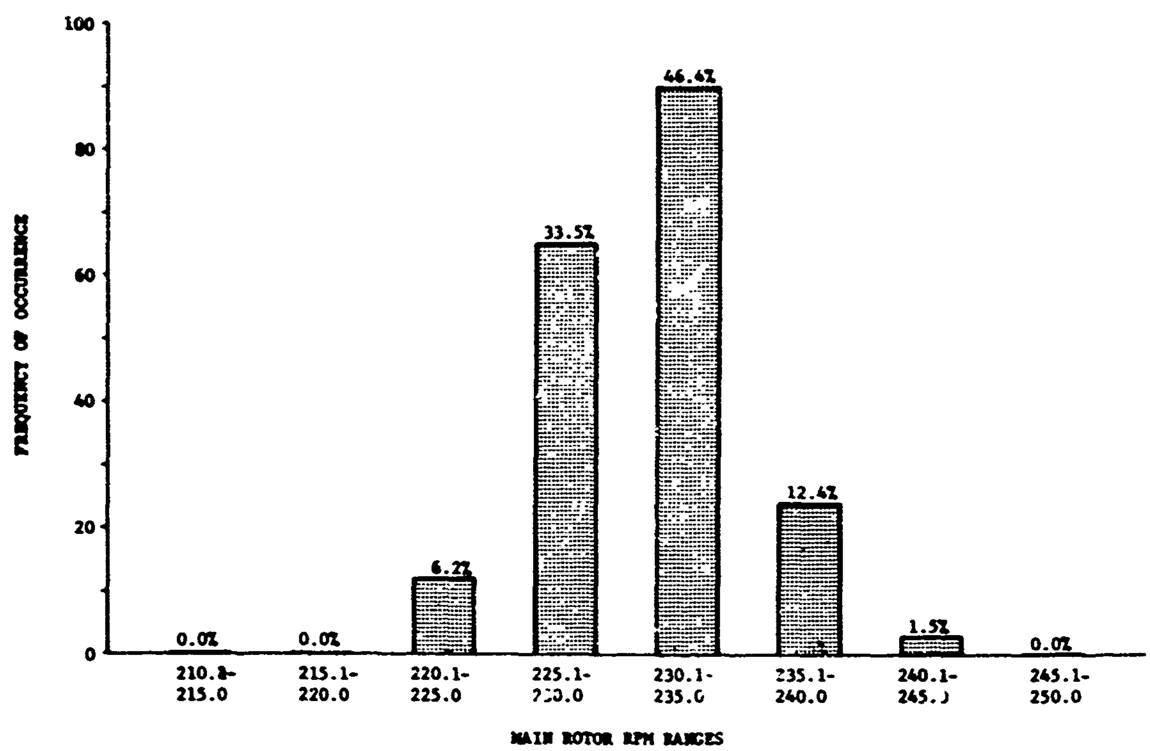

Figure 60. Main Rotor RPM Versus Frequency of Occurrence at 10- to 20-Percent Torque Split (194 Sample Points, Table I Data).

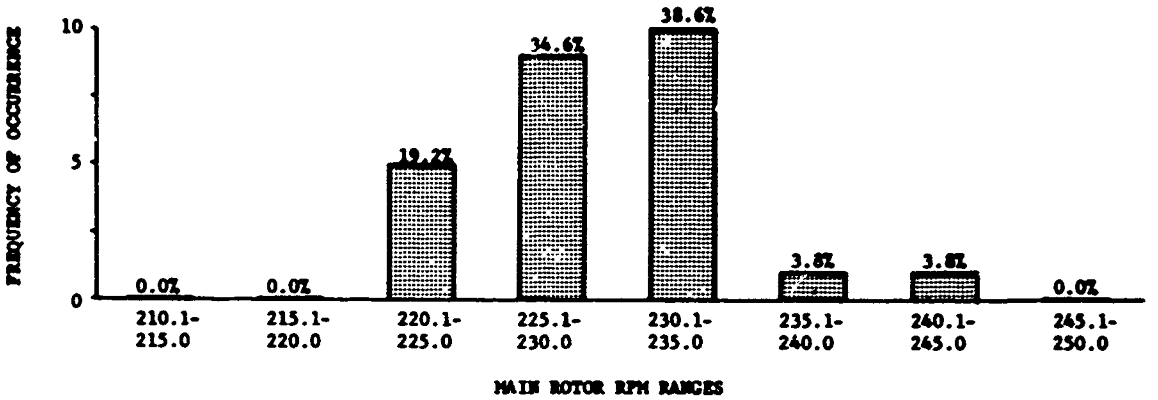

Figure 61. Main Rotor RPM Versus Frequency of Occurrence at 20- to 30-Percent Torque Split (26 Sample Points, Table I Data).

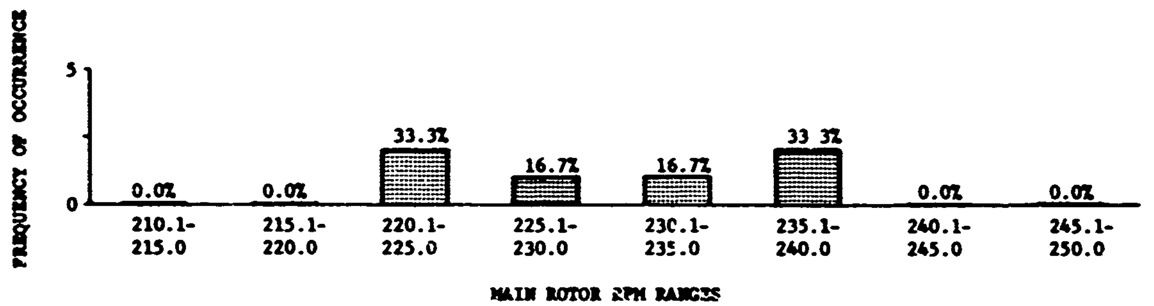

Figure 62. Main Rotor RPM Versus Frequency of Occurrence at 30- to 40-Percent Torque Split (6 Sample Points, Table I Data).

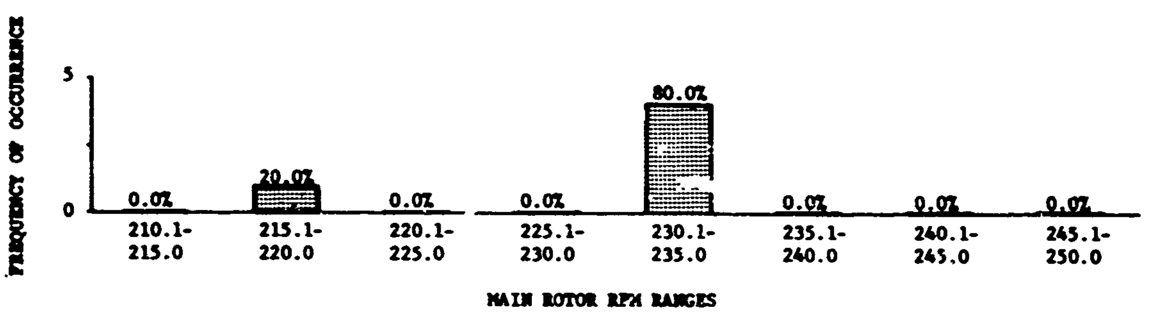

Figure 63. Main Rotor RPM Versus Frequency of Occurrence at 40- to 50-Percent Torque Split (5 Sample Points, Table I Data).

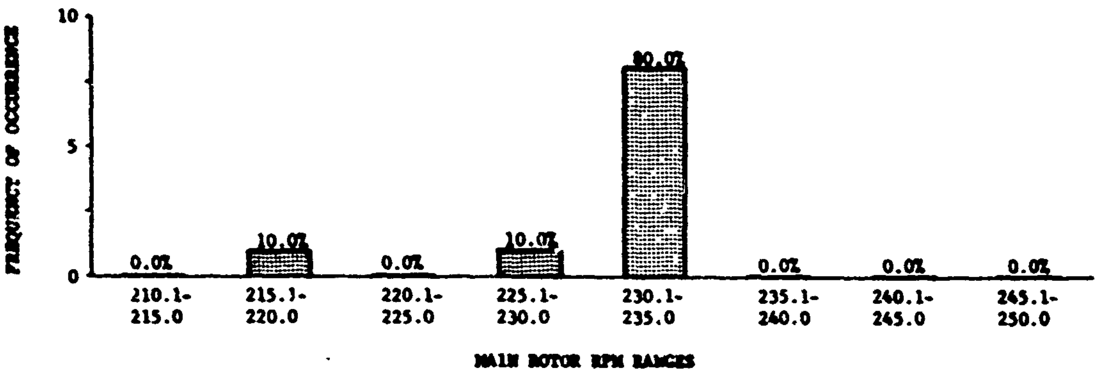

Figure 64. Main Rotor RPM Versus Frequency of Occurrence at 50- to 60-Percent Torque Split (5 Sample Points, Table I Data).

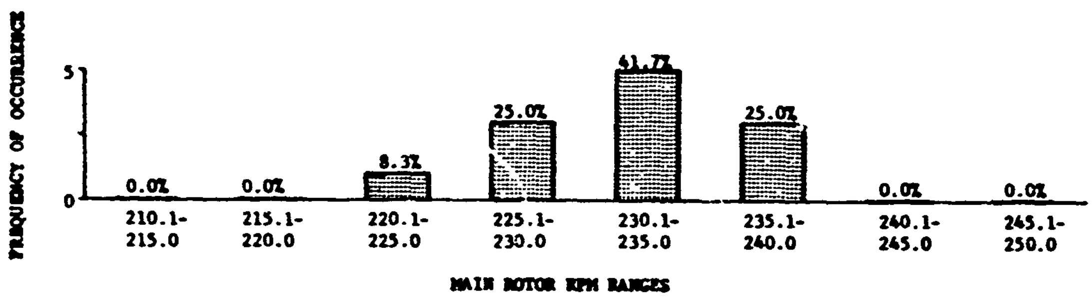

Figure 65. Main Rotor RPM Versus Frequency of Occurrence at 60- to 70-Percent Torque Split (12 Sample Points, Table I Data).

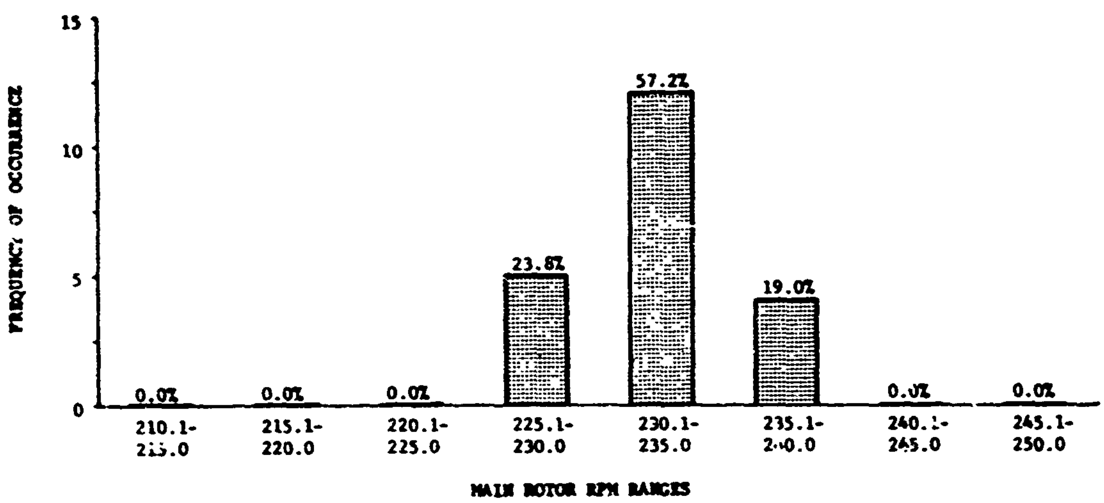

Figure 66. Main Rotor RPM Versus Frequency of Occurrence at 70- to 100-Percent Torque Split (21 Sample Points, Table I Data).

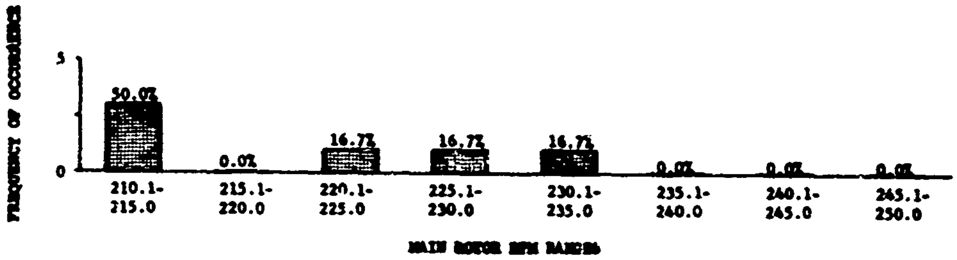

Figure 67. Main Rotor RPM Versus Frequency of Occurrence at Torque Split of 100 Percent and Greater (6 Sample Points, Table I Data).

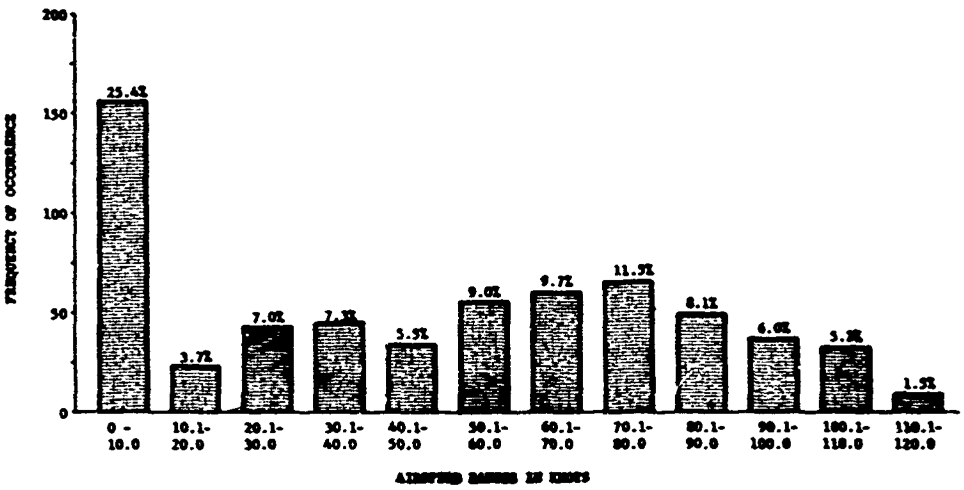

Figure 68. Summary: Airspeed Versus Frequency of Occurrence (618 Sample Points, Table I Data).

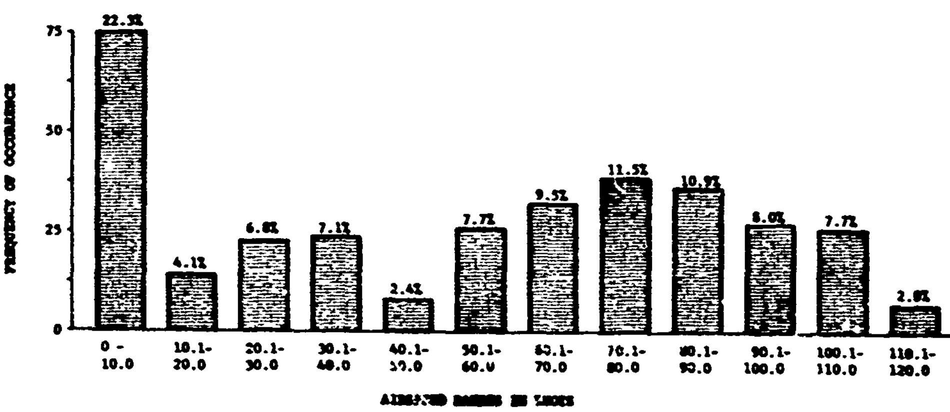

Figure 69. Airspeed Versus Frequency of Occurrence at 0- to 10-Percent Torque Split (338 Sample Points, Table I Data).

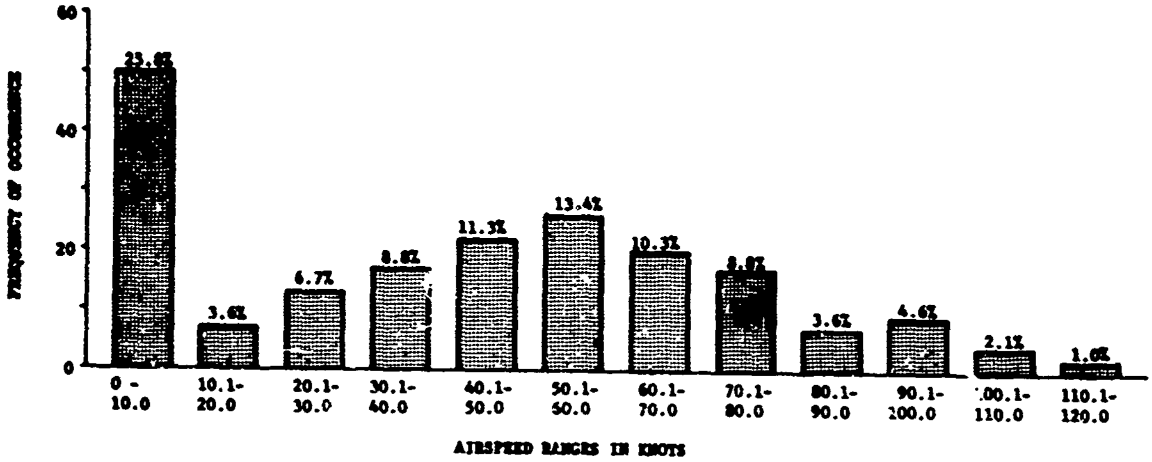

Figure 70. Airspeed Versus Frequency of Occurrence at 10- to 20-Percent Torque Split (194 Sample Points, Table I Data).

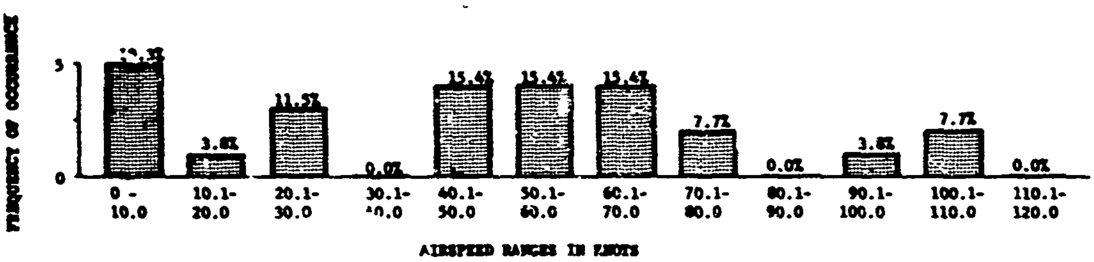

Figure 71. Airspeed Versus Frequency of Occurrence at 20- to 30-Percent Torque Split (26 Sample Points, Table I Data).

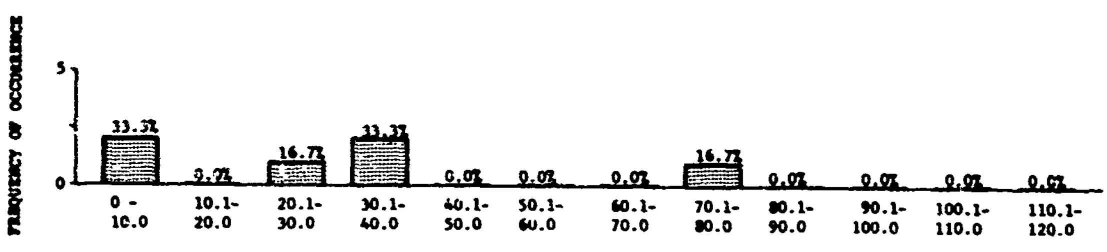

Figure 72. Airspeed Versus Frequency of Occurrence at 30- to 40-Percent Torque Split (6 Sample Points, Table I Data).

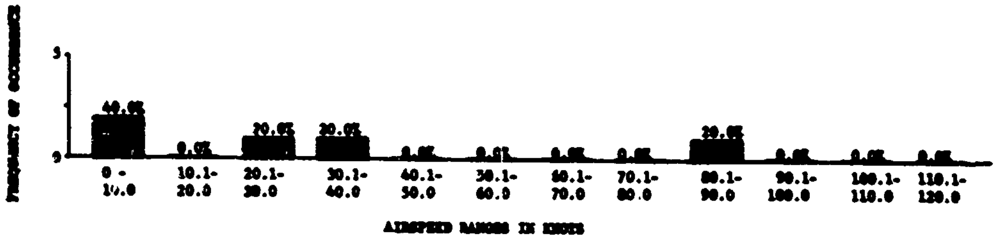

Figure 73. Airspeed Versus Frequency of Occurrence at 40- to 50-Percent Torque Split (5 Sample Points, Table I Data).

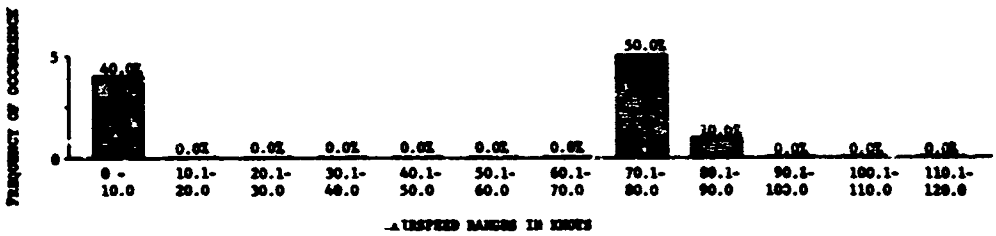

Figure 74. Airspeed Versus Frequency of Occurrence at 50- to 60-Percent Torque Split (10 Sample Points, Table I Data).

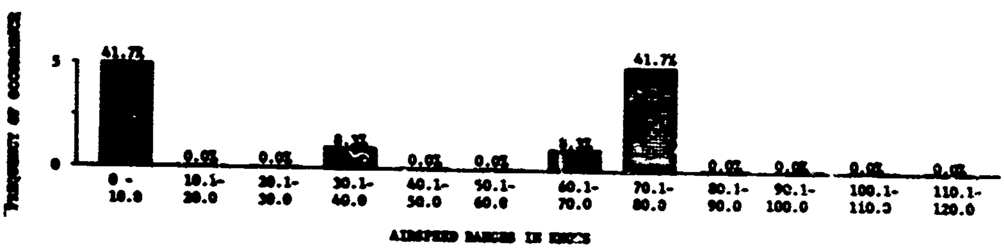

Figure 75. Airspeed Versus Frequency of Occurrence at 60- to 70-Percent Torque Split (12 Sample Points, Table I Data).

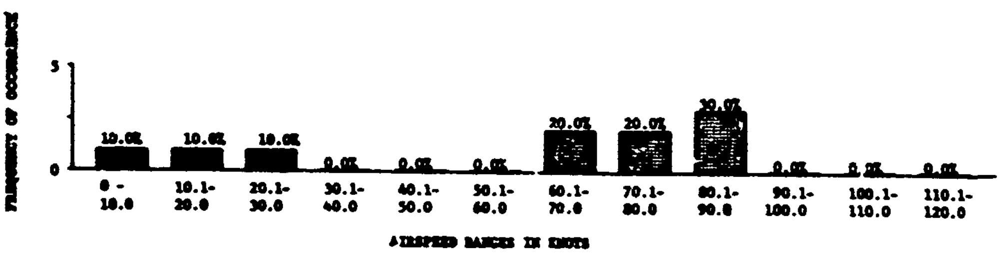

Figure 76. Airspeed Versus Frequency of Occurrence at 70- to 80-Percent Torque Split (10 Sample Points, Table I Data).

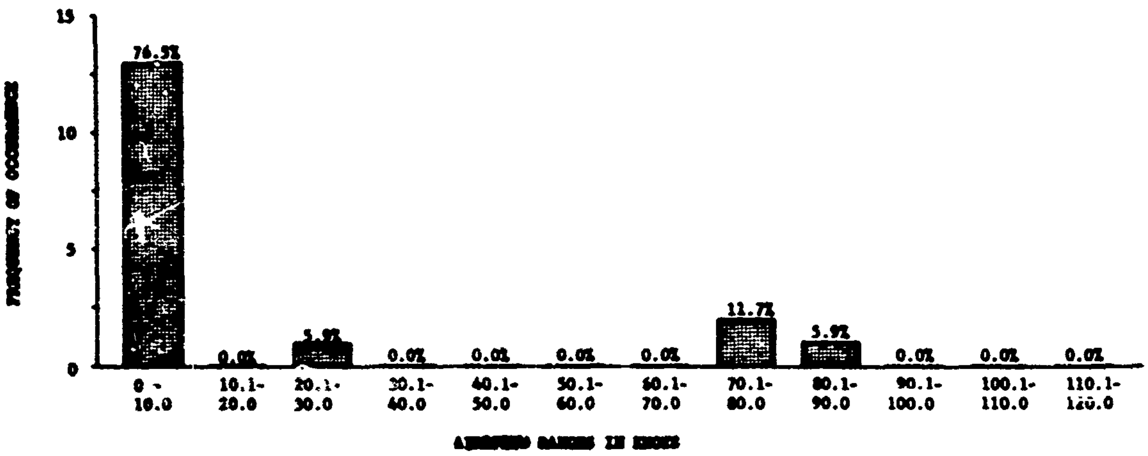

Figure 77. Airspeed Versus Frequency of Occurrence at 80- to 100-Percent Torque Split (17 Sample Points, Table I Data).

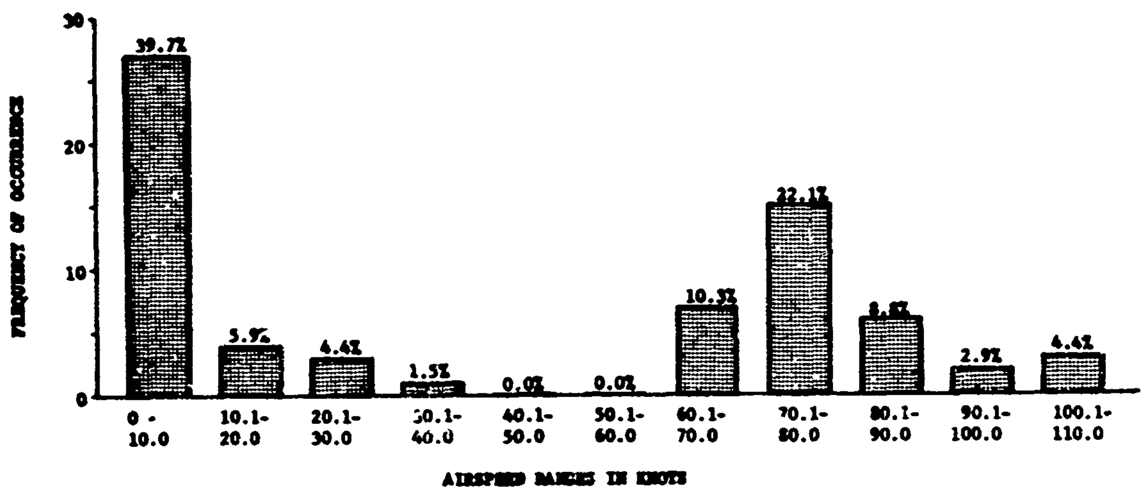

Figure 78. Airspeed Versus Frequency of Occurrence During Steady Operations With Torque Split Greater Than 10 Percent (68 Sample Points, Table I Data).

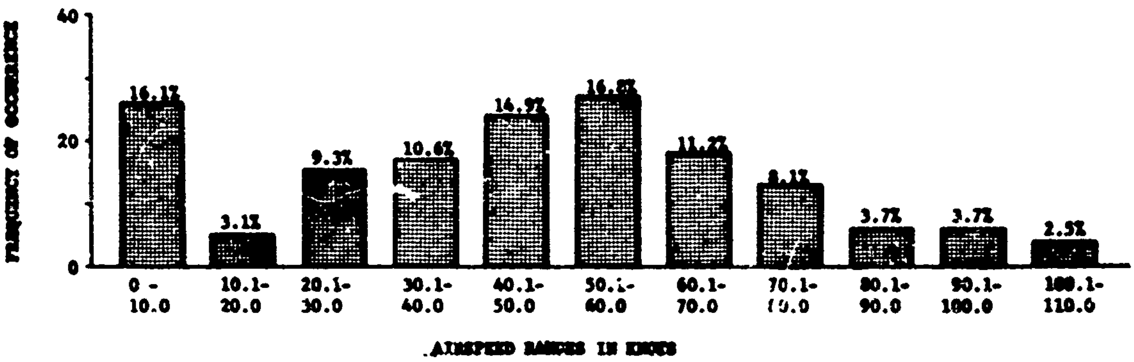

Figure 79. Airspeed Versus Frequency of Occurrence During Descent Operations With Torque Split Greater Than 10 Percent (161 Sample Points, Table I Data).

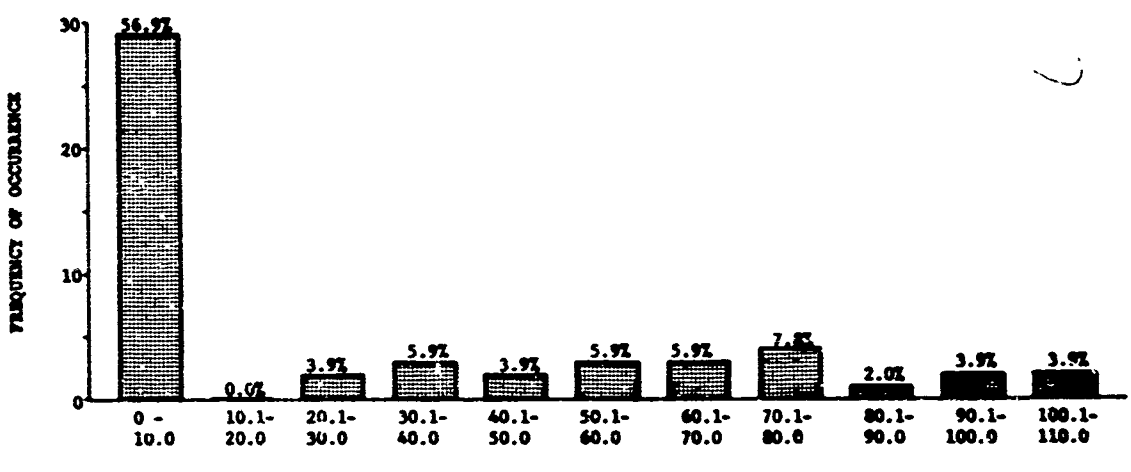

Figure 80. Airspeed Versus Frequency of Occurrence During Ascent, Hover, and Maneuver Operations With Torque Split Greater Than 10 Percent (51 Sample Points, Table I Data).

TABLE I. INVESTIGATION OF CH-47A HELICOPTER ENGINE LOAD SHARING (INSTRUMENTATION COMPLETE)

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
1	908	82A	5.4	22,800	6.16	0.00	12,946	10,090	743	749	232.5	68.8	5161	98.37
1		82A	5.8	22,800	34.65	20.45	17,261	12,813	822	849	229.5	44.5	4606	95.02
1		82A	6.0	22,800	43.12	37.98	17,818	14,014	811	849	231.5	31.9	4653	95.02
2		82A	22.3	21,900	32.34	34.33	16,426	13,213	754	782	234.5	82.5	5305	98.37
2		82A	23.1	21,900	29.26	16.07	16,704	12,492	799	849	230.5	77.9	4623	96.70
2		82A	23.8	21,900	21.56	8.77	16,147	11,532	822	916	235.5	42.3	4337	95.86
2		82A	24.4	21,800	37.73	35.06	17,540	13,854	799	849	230.5	0.0	4126	95.86
3		84A	44.0	22,600	25.41	27.03	17,818	15,213	743	816	233.5	86.1	6499	99.93
3		84A	45.0	22,600	56.21	0.00	18,514	7,527	766	637	217.6	80.0	5853	99.09
3		84A	46.0	22,600	61.60	1.46	18,932	6,406	912	760	231.5	74.9	5756	98.26
3		84A	47.0	22,500	60.83	2.19	18,932	6,486	924	760	231.5	75.2	5731	98.2
3		84A	48.0	22,500	63.91	2.19	18,932	6,566	924	760	229.5	77.7	5682	97.42
3		84A	49.0	22,500	52.36	2.19	18,514	6,406	901	760	227.5	72.2	5632	96.58
3		84A	49.3	22,500	35.42	29.21	17,122	13,213	811	883	234.5	74.9	5461	94.91
4		84A	49.7	22,400	32.34	34.33	16,983	13,453	788	827	234.5	74.7	5534	95.74
4		84A	50.0	22,400	43.12	12.42	18,096	12,332	822	760	234.5	75.1	5584	96.58
4		84A	50.3	22,400	60.06	13.15	18,792	11,692	912	794	232.5	82.3	5486	95.74
4		84A	50.8	22,400	63.91	10.96	18,932	11,692	901	771	233.5	85.9	5608	96.58
4		84A	51.1	22,400	33.11	35.79	17,122	13,613	788	872	233.5	82.2	5730	97.42
5		85A	10.5	29,700	[illegible]	23.37	16,426	13,213	743	827	232.5	70.9	6428	90.72
5		85A	11.7	29,600	23.10	11.69	16,426	12,172	743	816	234.5	50.5	4947	86.53
5		85A	12.0	29,600	52.36	45.29	18,375	14,414	879	902	233.5	25.3	4837	85.70
6		85A	17.0	22,400	29.26	28.49	16,704	13,693	743	816	236.5	86.3	6615	90.72
6		85A	17.4	22,400	33.11	21.18	17,122	12,893	766	850	230.5	89.5	6204	89.05
6		85A	17.9	22,400	23.10	14.61	16,287	11,611	743	839	230.5	89.9	5708	85.21
6		85A	18.7	22,400	36.96	21.18	17,400	13,373	788	850	230.5	70.0	4612	83.19
6		85A	19.4	22,300	36.96	37.98	17,400	13,934	788	925	229.5	86.1	4288	80.67
7		87A	14.6	22,500	12.32	13.88	14,895	12,012	784	857	225.6	63.2	4791	78.35
7		87A	15.3	22,500	43.89	31.41	17,957	13,453	852	879	227.5	0.0	4266	78.35
7		87A	15.8	22,400	53.90	40.90	18,096	13,693	877	980	223.6	0.0	4182	78.35
7		87A	16.4	22,400	32.34	29.21	17,400	13,533	796	868	230.5	0.0	4013	78.35
8		87A	115.0	21,600	36.96	43.10	17,540	14,174	818	946	228.5	0.0	3502	67.47
8		87A	115.4	27,600	86.24	65.01	19,488	15,135	1010	1047	229.5	27.1	3624	67.47
8		87A	116.0	27,500	63.91	65.01	19,209	14,975	931	1047	232.5	65.7	4167	68.30
9		87A	195.9	26,400	15.40	22.64	15,312	12,893	784	868	227.5	50.0	1750	67.47
9		87A	196.6	26,400	48.51	35.79	18,096	13,693	886	924	232.5	9.1	1278	66.63
9		87A	197.2	26,400	52.36	51.86	18,236	14,414	897	980	232.5	0.0	1108	65.79
10		88A	63.7	24,000	28.49	24.10	16,843	12,893	750	845	228.5	65.1	3687	74.84
10		88A	64.9	23,700	52.36	39.44	18,375	13,693	828	923	226.5	9.1	3019	73.16
10		88A	65.2	19,700	47.74	44.56	18,096	14,414	885	956	237.5	31.6	[illegible]	69.31
11		89A	55.6	20,500	13.09	19.72	15,451	12,733	798	848	227.5	74.9	6653	103.23
11		89A	56.0	20,500	21.56	10.96	16,287	11,692	753	826	232.5	73.4	5959	100.72
11		89A	56.6	20,500	17.71	21.18	15,034	12,492	753	860	233.5	73.6	5075	95.70
12		90A	4.6	28,900	40.81	43.10	17,540	14,014	847	981	230.5	0.0	3539	86.33
12		90A	5.0	28,900	79.31	54.05	19,488	14,895	1015	1048	231.5	44.3	3751	86.33
12		90A	5.4	28,900	50.82	54.05	18,236	14,494	926	993	235.5	64.3	4085	87.16
13		91A	56.6	28,900	3.85	5.84	13,503	11,211	696	767	231.5	63.1	4868	86.21
13		91A	57.0	28,900	60.06	40.90	18,792	14,014	922	997	229.5	46.0	4010	82.02
13		91A	57.1	28,900	83.16	54.05	19,906	14,414	1012	1020	225.6	72.7	4079	81.19
13		91A	57.4	28,900	53.90	57.70	18,514	14,734	922	1055	224.6	39.5	4220	80.35

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
14	908	92A	0.9	23,000	34.65	39.44	17,122	14,414	794	878	235.5	68.7	3780	85.84
14		92A	1.4	23,000	21.56	3.65	16,426	11,211	772	755	235.5	49.1	3839	85.84
14		92A	1.9	23,000	38.50	36.52	17,818	13,934	885	934	227.5	9.1	3685	85.84
15		92A	24.3	26,600	41.58	46.01	17,540	14,174	761	889	231.5	0.0	3375	78.30
15		92A	24.8	26,600	79.31	56.97	20,045	14,815	997	1012	233.5	68.3	3514	77.47
15		92A	25.0	26,600	60.06	59.90	18,792	14,815	918	1023	230.5	76.9	3892	81.65
16		92A	51.8	30,000	44.66	44.56	18,096	14,334	873	990	234.5	0.0	3634	82.49
16		92A	52.0	30,000	77.00	52.59	19,767	14,734	986	1001	232.5	0.0	3670	82.49
16		92A	52.4	30,000	56.52	57.70	18,792	14,654	907	1012	230.5	54.6	4031	83.33
17		92A	54.2	29,900	34.65	34.33	17,400	13,693	772	900	234.5	51.5	5321	86.67
17		92A	55.1	29,900	56.21	41.63	15,792	14,254	907	1001	225.6	0.0	5163	86.67
17		92A	55.6	22,900	44.66	45.29	18,096	14,254	885	990	224.6	0.0	4928	85.00
18		92A	85.8	21,600	39.27	37.25	17,540	13,854	851	957	230.5	0.0	3736	84.16
18		92A	86.3	21,600	80.08	61.36	19,628	14,815	986	1068	227.5	31.9	3547	84.16
18		92A	86.7	21,600	63.91	61.36	18,932	14,815	940	1045	231.5	66.4	4046	84.16
19		94A	4.7	22,900	21.56	13.88	16,287	12,332	829	868	235.5	55.6	3919	81.70
19		94A	5.3	22,900	56.21	35.79	18,653	13,613	886	957	223.6	0.0	3255	77.51
19		94A	5.5	22,900	45.43	32.87	18,096	14,334	863	890	226.5	0.0	3203	76.67
20		95A	8.5	22,700	0.00	56.97	0	15,215	120	1047	232.5	0.0	3293	83.47
20		95A	9.1	22,700	0.00	59.16	0	15,215	120	1080	233.5	0.0	3237	82.94
20		95A	9.3	22,700	0.00	56.24	0	15,215	120	1047	232.5	0.0	3326	84.00
21		96A	11.9	22,500	0.00	40.90	7,378	14,414	852	777	234.5	0.0	4285	93.41
21		96A	12.5	22,500	0.00	68.38	7,517	16,016	852	935	229.5	0.0	4226	93.41
21		96A	12.9	22,500	0.00	40.90	7,517	14,414	841	788	233.5	0.0	4253	92.88
22		96A	12.9	22,500	56.21	0.00	18,653	6,807	905	777	234.5	0.0	4230	92.88
22		96A	13.4	22,500	80.08	0.00	18,375	6,727	1009	777	228.5	0.0	4285	93.41
22		96A	13.6	22,500	67.76	0.00	19,488	6,887	964	766	239.5	0.0	4230	92.88
23		97A	17.3	22,500	87.01	0.00	19,488	0	964	152	229.5	0.0	1290	73.47
23		97A	17.8	22,500	82.39	0.00	18,653	0	1009	141	235.5	76.9	1405	72.94
23		97A	18.3	22,400	80.85	0.00	20,045	0	998	119	236.5	72.3	1796	73.47
24		97A	18.8	22,400	72.38	0.00	19,349	0	953	108	233.5	75.6	2187	74.53
24		97A	19.5	22,400	65.45	0.00	19,349	0	930	96	233.5	77.9	2748	75.06
24		97A	20.8	22,400	58.52	0.00	18,792	0	905	96	233.5	76.1	3017	75.59
25		97A	33.7	21,900	61.60	0.00	18,792	0	905	74	231.5	75.9	4098	78.76
25		97A	34.9	21,800	30.80	0.00	17,122	0	772	74	236.5	30.3	3348	78.24
25		97A	35.9	21,600	80.85	0.00	19,767	0	1009	74	238.5	0.0	2951	74.53
26		99A	25.4	21,700	58.52	40.90	17,400	14,414	946	782	240.5	0.0	3784	94.24
26		99A	25.6	21,700	26.18	[illegible]	16,565	14,654	788	894	234.5	37.5	3877	94.24
26		99A	26.2	21,600	43.12	45.29	17,957	14,414	878	782	233.5	80.1	4158	94.24
27		01B	5.4	22,800	20.02	23.37	16,565	13,453	762	723	235.5	90.9	5499	90.24
27		01B	6.3	22,800	7.70	23.37	14,755	13,053	751	689	233.5	55.7	4821	90.24
27		01B	7.9	22,700	27.72	27.76	16,983	14,414	795	734	233.5	69.[illegible]	3217	90.24
28		01B	9.8	28,600	71.61	48.21	19,767	15,[illegible]55	976	857	[illegible]	0.0	2391	90.24
28		01B	10.1	28,600	53.90	39.44	18,514	14,094	908	723	235.5	79.0	2745	90.24
28		01B	10.9	28,600	38.50	46.75	17,679	14,494	818	812	234.5	77.2	3578	90.24
29		01B	27.2	26,700	32.34	30.68	17,261	13,693	773	700	235.5	86.1	5633	90.24
29		01B	28.7	26,700	0.00	11.69	11,415	12,012	740	689	228.5	79.0	3906	90.24
29		01B	29.7	26,600	35.42	42.36	17,400	14,574	840	823	232.5	0.0	2357	90.24

TABLE I - contd

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
30	908	01B	29.9	21,600	52.36	50.40	18,375	14,654	908	790	238.5	0.0	2301	90.24
30		01B	30.2	21,600	72.38	59.90	19,349	15,215	964	890	238.5	51.5	2688	90.24
30		01B	30.6	21,600	54.67	55.51	18,653	14,895	908	868	233.5	70.3	3182	90.24
31		01B	34.4	21,400	40.04	39.44	17,818	14,414	840	767	234.5	50.2	6101	90.24
31		01B	34.7	21,400	32.34	30.68	17,122	13,774	762	723	235.5	13.1	6039	90.24
31		01B	35.1	21,300	58.52	70.12	18,653	15,455	883	890	228.5	13.1	6002	90.24
32		01B	63.4	22,600	17.71	23.37	16,002	13,533	750	689	233.5	75.8	5560	90.24
32		01B	64.5	22,500	7.70	24.10	14,199	13,293	759	711	228.5	64.4	4569	90.24
32		01B	65.4	22,500	7.70	25.57	14,199	13,533	750	723	227.5	66.3	3484	90.24
33		01B	70.2	28,300	24.64	29.94	16,704	13,854	750	689	234.5	82.3	5159	90.24
33		01B	70.7	28,300	3.08	18.99	13,224	13,213	750	678	233.5	50.5	4701	90.24
33		01B	71.2	28,300	44.66	45.29	17,957	14,574	784	778	226.5	13.1	4177	90.24
34		01B	71.5	28,200	43.12	40.90	18,096	14,414	863	734	235.5	0.0	4118	90.24
34		01B	71.8	28,200	74.69	64.28	19,628	15,295	976	879	235.5	45.4	4201	90.24
34		01B	72.4	28,200	44.66	53.32	18,096	14,895	987	834	235.5	80.5	4486	90.24
35		01B	90.2	21,500	29.26	33.60	18,653	14,734	750	689	236.5	80.5	5316	90.24
35		01B	91.1	21,400	9.24	37.98	16,983	13,854	761	711	227.5	55.7	4059	90.24
35		01B	91.4	21,400	23.87	25.57	15,312	12,893	750	700	234.5	46.3	3964	90.24
36		04B	25.3	23,100	13.86	18.99	16,147	13,453	877	798	234.5	0.0	2691	89.54
36		04B	26.0	23,000	6.16	21.91	14,477	13,293	950	793	240.5	0.0	2691	89.54
36		04B	27.0	23,000	30.80	40.90	16,704	13,934	866	770	235.5	20.8	2725	89.54
37		05B	24.2	22,200	23.87	30.68	17,818	15,776	834	795	232.5	0.0	2562	91.54
37		05B	24.4	22,100	56.38	45.75	17,818	14,734	924	817	236.5	0.0	2596	91.54
37		05B	24.7	22,100	46.91	50.40	17,540	13,774	913	862	233.5	[illegible]	2710	91.54
38		05B	27.7	22,000	19.25	24.83	18,514	13,934	856	761	235.5	0.0	2596	91.54
38		05B	27.9	22,000	44.66	32.14	18,096	14,654	935	750	238.5	0.0	2676	91.54
38		05B	28.9	22,000	55.44	59.16	17,400	14,254	946	892	233.5	87.6	3458	91.54
39		07B	81.8	28,000	45.43	44.56	18,096	14,574	873	766	231.5	0.0	5558	87.15
39		07B	82.2	29,000	55.44	37.98	18,932	15,055	995	789	232.5	0.0	5375	87.13
39		07B	82.4	20,590	42.35	41.63	18,096	14,734	862	733	231.5	9.1	5558	87.15
40		08B	0.0	23,100	12.30	25.60	15,034	13,053	819	780	230.52	0.0	3652	88.00
40		08B	0.1	23,100	50.70	36.60	18,514	14,414	921	758	239.46	5.1	3688	88.00
40		08B	0.2	23,100	49.10	40.[illegible]0	18,375	14,494	910	791	239.46	37.7	3746	88.00
40		08B	0.3	23,100	13.80	38.80	18,096	14,494	895	780	237.47	50.2	3805	88.00
41		08B	9.0	22,800	19.20	23.40	16,287	12,813	736	679	231.51	73.7	3383	88.00
41		08B	9.2	22,800	6.90	23.40	14,338	12,412	830	679	227.43	55.6	3383	88.00
41		08B	9.4	22,800	10.00	30.70	15,173	13,533	864	723	225.55	29.1	3081	88.00
41		08B	9.6	22,800	14.60	54.20	17,400	13,693	808	723	228.53	5.1	2986	88.00
42		08B	9.9	22,700	14.60	17.60	15,451	12,572	786	690	231.51	0.0	2988	88.00
42		08B	10.0	22,700	27.60	46.10	16,426	13,693	888	835	226.54	0.0	2953	88.00
42		08B	10.1	22,700	52.20	41.70	18,236	14,254	910	769	234.49	0.0	2953	88.00
43		08B	72.1	23,100	17.70	24.20	15,869	13,453	797	701	236.48	0.0	2930	88.00
43		08B	72.2	23,100	35.30	52.70	17,261	14,494	943	835	233.50	0.0	2838	88.00
43		08B	72.3	23,100	56.80	38.10	18,792	14,334	896	712	239.46	0.0	2861	88.00
43		08B	72.5	23,100	42.20	42.50	17,957	14,494	864	768	231.51	0.0	2896	88.00
44		08B	128.9	20,900	7.70	22.70	14,338	12,973	764	699	235.48	0.0	3011	88.00
44		08B	129.0	20,900	12.30	30.70	16,565	14,574	775	712	234.49	0.0	2988	88.00
44		08B	129.1	20,900	36.90	36.10	18,236	14,334	853	813	231.51	0.0	2988	88.00
45		08B	129.3	20,900	39.20	44.60	17,957	14,414	797	746	233.50	0.0	3011	88.00

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kt)	Density Alt (ft)	Outside Air Temp (°F)
45	908	12B	2.2	23,000	41.58	29.21	18,375	14,414	902	739	234.5	0.0	3781	[illegible]
45		12B	2.5	23,000	0.00	69.39	7,795	16,576	834	940	227.5	0.0	3833	89.43
45		12B	3.0	23,000	0.60	67.20	7,795	15,576	846	929	230.5	0.0	3816	88.57
45		12B	3.4	22,900	73.92	0.00	20,045	6,727	902	772	[illegible]	0.0	3712	86.86
45		12B	4.3	22,900	72.38	0.00	19,906	6,727	913	772	[illegible]	0.0	3712	86.86
45		12B	4.7	22,900	34.65	35.06	17,818	14,815	823	761	235.5	0.0	3748	86.86
46		12B	5.4	22,800	36.19	32.87	17,818	14,174	891	717	235.5	0.0	4265	96.00
46		12B	6.7	22,800	0.00	94.23	7,935	16,736	823	940	255.5	0.0	4296	97.14
46		12B	7.0	22,800	0.00	85.46	7,795	16,416	845	895	233.5	0.0	3810	89.43
46		12B	7.6	22,700	36.19	34.33	17,818	14,334	657	717	236.5	0.0	4084	94.57
47		12B	11.7	22,600	42.35	42.36	18,096	14,734	891	761	236.5	0.0	4256	98.86
47		12B	12.1	22,500	0.00	99.34	7,795	16,736	834	918	233.5	0.0	4281	98.86
47		12B	12.5	22,500	0.00	100.07	7,795	16,736	834	906	233.5	0.0	4316	98.86
47		12B	12.9	22,500	0.00	39.44	7,795	14,334	823	772	223.6	0.0	4281	98.86
47		12B	13.1	22,500	62.39	0.00	20,184	7,047	947	750	232.5	0.0	4281	98.86
47		12B	14.0	22,400	66.99	0.00	19,488	7,047	756	739	235.5	0.0	4265	98.00
47		12B	14.2	22,400	43.12	43.33	18,096	14,734	891	772	235.5	0.0	4316	98.86
48		19B	42.1	23,300	50.05	37.98	18,792	14,574	921	736	236.48	0.0	4129	82.00
48		19B	42.6	23,300	47.74	36.52	18,653	14,414	943	758	236.48	64.7	4587	84.57
48		19B	43.5	22,700	50.05	40.17	18,653	14,734	954	669	234.50	0.0	4446	85.43
49		21B	25.7	26,400	20.02	18.26	16,287	13,293	686	681	235.48	56.4	4537	75.43
49		21B	26.3	26,300	47.74	34.33	18,096	14,334	900	692	234.49	14.6	4281	75.43
49		21B	26.6	26,300	34.65	28.49	17,400	13,934	810	714	231.51	0.0	4207	75.43
50		22B	81.0	25,900	20.79	20.45	16,008	13,453	738	699	233.50	0.0	2672	85.86
50		22B	81.2	25,900	71.61	59.16	19,488	15,535	907	875	236.48	0.0	3419	93.57
50		22B	81.4	25,900	51.59	47.48	18,236	14,895	916	656	234.50	67.8	3669	92.71
51		24B	32.3	21,700	40.81	33.60	17,557	14,254	870	696	234.49	39.5	3030	74.29
51		24B	33.0	21,600	63.06	45.29	18,932	14,734	904	786	231.51	17.9	2983	74.29
51		24B	33.4	21,600	21.55	23.37	16,426	13,533	756	685	238.46	0.0	2971	74.29
52		24B	219.9	24,500	27.72	26.30	16,843	13,934	724	696	235.48	54.3	1732	74.29
52		24B	220.3	24,400	48.51	40.17	18,514	14,654	915	730	234.49	66.5	1399	74.29
52		24B	220.9	24,400	51.59	40.90	18,514	14,734	927	775	234.49	72.2	1491	74.29
52		24B	221.3	24,400	32.34	30.68	17,400	14,094	769	707	237.47	68.6	1548	74.29
53		29B	17.0	22,300	2.31	3.65	12,528	10,330	733	661	236.47	67.8	5089	86.86
53		29B	17.3	22,300	29.26	16.07	16,843	13,133	733	683	235.48	67.7	4537	85.14
53		29B	17.5	22,300	28.49	25.57	16,843	13,053	744	694	237.47	63.1	4485	84.29
54		31B	9.1	28,200	21.56	23.37	16,565	13,854	738	687	235.48	0.0	3837	73.57
54		31B	5.4	28,100	32.34	18.26	17,261	13,373	760	721	233.50	0.0	3819	74.71
54		31B	9.7	28,100	50.82	46.75	18,375	14,734	922	799	233.50	0.0	3910	73.57
55		32B	0.0	23,100	21.56	30.68	16,147	14,014	762	723	233.50	0.0	3991	75.86
55		32B	0.3	23,100	58.52	46.75	18,932	14,895	942	823	238.46	0.0	4117	76.71
55		32B	0.9	23,100	56.21	41.63	18,792	14,654	942	779	227.53	23.6	4117	76.71
55		32B	1.3	23,000	41.58	40.17	18,236	14,895	875	790	236.48	37.7	4088	75.86
56		32B	6.5	22,700	20.79	23.37	16,565	13,854	706	678	233.50	30.6	4607	80.14
56		32B	6.8	22,700	55.44	40.90	19,077	14,734	908	768	233.50	0.0	4441	78.43
56		32B	7.3	26,300	37.73	40.90	17,957	14,815	864	779	234.49	20.5	4335	76.71
57		33B	19.6	22,300	33.11	27.76	17,540	14,094	791	625	234.49	43.2	2253	67.43
57		33B	20.0	22,300	70.84	54.05	19,488	15,215	892	829	227.53	13.1	2182	67.43
57		33B	20.5	22,200	66.22	63.55	19,488	15,615	914	785	234.49	0.0	2029	67.43
58		34B	63.3	24,800	12.32	12.42	15,173	13,053	722	661	233.50	80.9	5528	91.14
58		34B	63.9	24,700	20.79	8.03	16,008	12,252	733	672	226.54	52.3	4592	89.43
58		34B	64.5	24,700	36.19	42.36	18,096	14,975	857	795	228.55	0.0	4135	88.57

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
59	908	35B	50.5	26,4[illegible]	26.18	25.57	16,704	13,774	711	662	233.50	39.6	1649	56.43
59		35B	50.8	26,400	59.29	40.17	18,996	14,094	933	706	227.53	24.9	1556	66.43
59		35B	51.6	26,300	43.89	41.63	18,096	14,815	880	761	237.47	0.0	1157	65.57
60		36B	200.7	21,200	26.18	24.10	16,704	13,854	801	672	235.48	56.9	3250	77.43
60		36B	201.3	21,200	70.07	54.76	19,488	15,295	868	817	229.[illegible]2	17.9	3220	80.00
60		36B	202.2	21,100	51.59	54.05	18,653	15,135	857	851	233.[illegible]0	0.0	2770	74.86
61		39B	0.0	23,100	9.20	20.49	14,477	13,293	758	707	235.48	0.0	3856	90.00
61		39B	0.4	23,100	20.00	38.00	16,267	14,654	747	774	238.46	0.0	3950	90.00
61		39B	0.8	23,100	39.30	41.60	17,957	14,654	938	797	235.48	0.0	3832	90.00
62		40B	0.0	23,100	25.40	32.90	16,565	14,294	825	752	235.48	0.0	3685	87.00
62		40B	0.5	23,100	32.30	49.70	17,540	15,215	792	875	236.48	53.2	3839	87.00
62		40B	0.9	23,100	39.30	45.40	17,957	14,895	916	853	234.49	90.2	4076	87.00
63		41B	20.0	25,200	26.20	26.30	16,704	13,774	740	701	233.50	106.5	3883	87.14
63		41B	20.6	25,200	54.70	16.10	18,375	13,293	887	757	225.55	72.2	3202	87.14
63		41B	21.1	25,100	45.40	33.60	17,957	14,334	920	701	231.51	77.7	3261	87.14
64		41B	52.4	22,000	27.00	26.30	16,565	13,854	695	690	233.50	92.0	5057	8[illegible].14
64		41B	53.3	21,900	21.60	5.80	16,008	11,852	740	668	227.53	66.5	3753	87.14
64		41B	54.1	21,900	34.60	16.80	15,869	12,492	662	679	230.52	30.2	2774	87.14
64		41B	54.4	21,900	42.30	39.70	17,679	14,414	865	723	230.52	0.0	2590	87.14
65		42B	89.5	21,100	19.25	21.18	16,426	13,854	649	667	237.47	83.9	3654	92.86
65		42B	89.9	21,100	34.65	21.18	17,122	13,453	750	678	232.50	39.2	3578	93.71
65		42B	90.4	21,000	44.66	32.14	17,679	14,014	674	700	231.51	17.1	3427	93.71
65		42B	91.2	21,000	21.56	2[illegible].18	16,565	13,934	705	669	235.48	0.0	3283	92.86
66		42B	118.6	25,300	6.16	13.88	14,059	13,133	716	656	236.48	93.7	3977	92.00
66		42B	118.9	25,300	11.55	0.00	15,034	11,131	705	667	228.53	39.2	3509	92.00
66		42B	119.6	25,300	2[illegible].56	25.57	16,565	14,494	683	700	236.48	0.0	2868	89.43
67		42B	138.3	24,600	33.11	32.14	17,261	14,254	772	700	235.48	59.9	[illegible]	91.14
67		42B	138.8	24,600	61.60	46.01	18,792	14,734	907	776	228.53	0.0	4671	91.14
67		42B	139.1	24,600	11.55	17.53	15,312	13,293	750	689	229.52	0.0	4533	89.43
68		42B	150.9	26,100	22.33	24.83	16,565	13,934	683	669	234.49	101.3	4394	92.86
68		42B	151.2	26,100	21.56	6.57	15,730	12,252	750	667	227.53	83.7	4000	92.90
68		42B	151.8	26,000	29.26	9.50	16,704	12,412	727	678	227.53	34.3	3249	91.14
68		42B	152.3	26,000	17.71	18.26	15,451	13,293	750	689	225.55	0.0	2873	87.71
69		42B	174.8	20,000	17.71	21.18	16,008	13,774	694	678	236.48	73.5	5279	92.86
69		42B	175.1	20,000	35.42	16.80	17,400	13,213	750	711	232.50	39.8	4854	92.00
69		42B	175.8	19,900	16.94	17.53	16,147	13,613	672	667	234.49	0.0	4525	90.29
70		42B	199.9	24,600	13.86	17.53	15,869	13,373	661	676	235.48	89.5	4266	88.57
70		42B	200.1	24,600	22.33	7.30	16,287	14,734	750	667	226.53	72.9	4017	88.57
70		42B	200.7	24,500	14.63	17.53	15,730	13,453	672	678	234.49	39.2	3185	85.14
71		42B	219.3	21,200	47.74	54.05	18,236	15,535	863	834	235.48	116.2	5775	92.00
71		42B	219.9	21,200	44.66	28.49	18,236	14,514	[illegible]	678	233.50	97.3	5565	[illegible].14
71		42B	220.5	21,100	38.50	33.60	17,957	14,654	[illegible]	700	234.49	98.2	5555	92.00
72		42B	249.0	19,900	13.03	17.53	15,173	13,133	726	667	234.49	83.7	4421	88.57
72		42B	249.5	19,900	23.87	4.38	16,426	11,531	750	672	226.54	111.9	3466	85.14
72		42B	250.3	19,900	21.56	24.83	16,843	14,57[illegible]	705	700	235.48	0.0	2729	81.71
73		42B	268.7	25,000	17.71	24.83	16,426	13,934	649	678	237.47	110.3	6257	92.86
73		42B	269.1	25,000	33.86	7.30	16,983	12,252	808	669	229.52	66.3	5826	92.86
73		42B	269.5	25,000	17.71	21.18	16,287	13,854	661	678	236.48	73.5	5494	92.00

TABLE I - contd.

Sample No.	Acft No	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
74	908	43B	17.5	[illegible]	17.71	23.37	16,287	13,854	679	674	236.48	67.7	3861	85.43
74		43B	16.0	[illegible]	32.34	16.80	17,540	13,133	780	696	232.50	30.7	3408	84.57
74		43B	18.3	24,800	60.06	62.09	19,349	15,695	870	864	232.50	20.1	3074	83.71
75		43B	50.9	24,900	22.33	19.99	16,426	13,613	701	674	232.50	62.1	3308	82.00
75		43B	51.4	[illegible]	73.15	59.16	19,488	15,455	859	842	226.54	21.2	2968	82.00
75		43B	52.0	24,900	66.22	54.05	19,071	15,375	903	853	227.53	0.0	2804	80.29
76		43B	125.1	[illegible]	16.46	16.25	16,008	13,533	723	674	234.49	55.3	3250	82.00
76		43B	128.9	24,800	75.46	61.36	19,628	15,535	927	875	232.50	0.0	2649	76.86
76		43B	129.3	[illegible]	65.45	60.63	19,488	15,615	916	875	233.50	0.0	2649	76.86
77		43B	268.1	23,000	21.56	31.41	17,400	14,414	745	696	235.48	117.2	3203	76.86
77		43B	268.7	23,000	80.85	60.63	20,045	15,535	905	864	230.52	14.9	2743	76.00
77		43B	269.7	23,000	29.26	26.49	17,957	14,654	756	707	235.48	0.0	2725	77.71
78		43B	321.3	23,500	21.56	21.91	16,704	13,934	668	685	235.48	89.2	4621	78.57
78		43B	321.8	23,500	43.89	24.10	18,096	13,774	905	718	230.52	9.1	4381	79.43
78		43B	322.2	23,500	15.40	16.80	15,869	13,693	679	674	233.50	0.0	4292	76.57
79		49B	21.9	25,500	17.71	19.72	16,704	13,373	675	662	235.48	88.7	3111	75.00
79		49B	22.4	25,500	23.67	10.23	16,985	12,492	712	662	234.49	62.3	2685	75.00
79		49B	22.8	25,400	26.95	13.88	17,261	17,813	757	673	233.50	28.1	2415	75.03
79		49B	23.2	25,400	40.04	37.98	18,514	14,414	903	684	234.49	18.1	2240	75.00
80		49B	59.0	22,700	20.02	27.03	16,843	13,774	700	662	235.48	100.0	3914	75.00
80		49B	59.8	22,600	19.25	7.30	16,426	11,531	746	651	229.52	68.6	2779	75.00
80		49B	60.3	22,600	24.64	7.30	17,261	12,092	735	673	231.51	54.1	2124	75.00
80		49B	61.1	22,600	46.91	21.18	18,514	13,213	869	706	228.53	0.0	1375	75.00
80		49B	61.6	22,600	43.89	37.96	18,096	14,094	926	695	232.50	0.0	1261	75.00
81		49B	87.9	22,900	15.40	21.18	16,426	13,533	689	662	235.48	91.1	4254	75.00
81		49B	88.4	22,900	23.10	5.64	16,704	12,092	802	651	228.53	57.1	3600	75.00
81		49B	89.0	22,900	18.48	13.26	16,565	13,373	768	662	236.48	24.6	3325	75.00
82		49B	109.0	25,500	20.02	21.18	16,565	13,613	745	673	235.48	52.2	2897	75.00
82		49B	109.4	25,500	23.87	8.03	17,122	12,332	745	662	233.50	45.2	2474	75.00
82		49B	110.1	25,400	18.48	4.35	16,565	11,531	723	651	231.51	14.8	1524	75.00
82		49B	110.5	25,400	44.66	42.36	18,375	14,654	914	762	233.50	0.0	1239	75.00
83		49B	124.5	23,300	16.94	16.80	16,565	13,293	723	662	236.48	57.7	2779	75.00
83		49B	125.3	23,300	19.25	1.46	16,704	11,932	723	[illegible]	235.48	39.4	1846	75.00
83		49B	125.8	23,300	38.50	28.49	18,236	14,094	881	695	235.48	21.3	1558	75.09
84		87B	7.8	22,600	16.94	26.30	14,477	13,533	713	763	234.49	85.1	3112	73.51
84		87B	8.2	22,600	27.72	12.42	14,615	11,932	803	774	226.54	31.1	2.21	73.51
84		87B	8.4	22,500	22.33	32.14	15,451	14,094	702	774	233.50	0.0	2609	72.67
85		87B	9.5	22,500	28.49	39.44	15,591	14,094	721	763	235.48	98.5	3172	73.51
85		87B	9.9	22,400	13.09	11.59	14,199	12,492	713	730	229.52	54.0	2875	73.51
85		87B	10.4	22,400	35.42	45.29	16,008	14,574	724	807	231.51	2.1	2633	72.67
86		89B	46.6	21,200	16.94	23.37	15,451	13,293	716	722	228.53	91.1	2428	53.79
86		89B	48.0	21,200	12.32	0.00	14,755	10,650	705	677	229.52	54.6	753	51.28
86		89B	48.4	21,200	16.17	0.00	15,034	10,731	750	732	229.52	39.1	753	51.28
86		89B	49.1	21,100	35.42	34.33	16,565	14,174	806	767	230.52	0.0	-507	46.25
87		89B	161.2	21,100	23.87	33.60	16,208	14,014	705	722	232.50	97.7	2069	52.95
87		89B	162.0	21,100	13.86	12.42	14,895	12,092	705	688	230.52	66.7	1330	52.12
87		89B	162.9	21,000	20.02	15.34	15,312	12,172	716	722	229.52	65.1	272	51.28
87		89B	163.7	21,000	35.42	46.75	16,287	14,334	806	789	233.50	9.1	-261	51.28
88		90B	55.1	22,600	24.64	32.14	15,869	13,693	702	719	231.51	32.4	3071	67.53
88		90B	55.6	22,500	24.64	[illegible]	15,312	11,692	735	685	226.54	0.0	2.45	64.19
88		90B	55.9	22,500	43.12	32.87	16,565	13,613	837	775	229.52	0.0	2372	63.35

TABLE 1 - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
89	908	91B	33.0	28,300	15.40	29.21	14,616	12,813	714	697	231.51	74.8	2082	77.86
89		91B	34.1	28,200	20.02	13.15	14,616	11,852	725	697	229.52	62.3	2490	76.19
89		91B	34.9	28,200	20.02	10.23	14,616	11,692	736	709	227.53	39.8	1626	75.35
89		91B	35.0	28,200	23.10	13.15	14,755	11,852	748	709	226.54	23.2	1473	76.19
90		91B	71.8	22,300	23.87	32.14	15,312	13,533	763	709	232.50	101.9	5848	[illegible]
90		91B	73.3	22,200	9.24	5.84	13,781	11,531	703	675	230.52	85.1	3260	77.02
90		91B	73.9	22,200	10.01	1.46	13,920	10,650	714	675	228.53	79.9	1954	74.51
90		91B	74.4	22,100	20.02	8.03	14,755	11,611	714	686	229.52	44.2	1310	74.51
91		91B	154.1	21,600	23.87	29.94	15,451	13,613	714	720	230.52	66.5	2713	74.51
91		91B	155.1	21,600	23.87	6.57	14,755	11,451	714	686	229.52	20.0	899	69.49
91		91B	155.8	21,600	35.42	42.36	16,287	14,094	793	775	234.49	0.0	529	67.81
92		91B	210.0	22,400	20.02	35.79	14,895	13,293	725	720	230.52	91.9	2077	67.81
92		91B	210.8	22,400	15.40	8.03	14,616	11,692	714	697	229.52	63.2	1533	66.98
92		91B	211.8	22,300	17.71	8.77	15,173	12,572	725	764	228.53	45.5	557	62.79
93		91B	228.5	21,600	23.87	27.72	15,312	13,213	725	709	231.51	94.2	1626	66.96
93		91B	229.3	21,600	20.02	9.50	14,755	11,531	725	657	228.53	69.2	1077	65.30
93		91B	230.2	21,600	20.02	13.88	14,895	12,492	736	709	230.52	44.0	164	60.28
94		91B	238.8	21,200	16.17	23.37	14,755	13,053	714	697	231.51	77.3	3051	73.67
94		91B	239.7	21,200	20.02	14.61	14,895	12,492	714	697	228.53	76.1	2021	71.16
94		91B	240.7	21,100	20.02	9.50	14,616	11,531	826	657	227.53	43.5	654	67.81
94		91B	241.2	21,100	34.65	38.71	15,869	13,293	793	775	229.52	4.1	305	66.98
95		92B	19.4	22,500	17.71	24.10	14,755	11,131	701	685	230.52	53.2	2109	62.23
95		92B	20.3	22,500	22.33	10.23	14,895	11,692	712	685	227.53	45.1	830	59.74
95		92B	21.4	22,500	40.81	44.56	16,287	14,094	802	752	229.52	0.0	-351	53.02
96		92B	68.0	21,100	20.02	23.37	15,034	13,213	701	685	233.50	78.2	2342	61.40
96		92B	68.5	21,100	16.17	8.03	14,755	11,371	690	663	230.52	61.8	1728	60.56
96		92B	69.0	21,100	15.40	8.03	14,616	11,451	701	674	230.52	68.3	1039	59.72
96		92B	69.6	21,100	27.72	11.69	15,592	12,012	712	707	228.53	32.4	260	57.21
96		92B	70.6	21,100	31.57	33.60	16,008	13,693	746	741	230.52	0.0	-467	52.19
97		94B	32.7	21,800	39.27	38.71	16,008	13,934	715	737	239.46	102.8	-245	45.84
97		94B	33.2	21,800	33.88	17.53	15,869	12,492	698	726	231.51	43.1	-273	48.35
97		94B	33.7	21,800	46.91	40.98	16,565	14,174	792	748	232.50	24.8	-491	47.51
98		94B	55.9	20,900	30.03	29.94	15,451	13,293	658	704	233.50	20.1	-56	50.02
98		94B	56.3	20,900	26.95	15.34	15,173	12,332	698	695	231.51	35.7	-195	50.02
98		94B	56.9	20,900	24.64	32.14	16,147	13,854	686	682	234.49	21.3	-460	50.02
99		94B	66.0	20,500	24.64	22.64	14,895	13,053	586	671	231.51	86.1	704	50.02
99		94B	66.6	20,500	24.64	10.23	15,035	11,772	598	671	231.51	52.2	305	50.02
99		94B	66.8	20,500	24.64	22.64	14,755	12,973	636	671	231.51	50.3	223	50.02
100		94B	97.1	26,300	17.71	21.91	14,336	12,973	698	682	232.50	83.8	-510	44.16
100		94B	97.6	26,300	40.03	23.37	15,869	12,893	749	759	224.55	24.3	-856	43.33
100		94B	97.9	26,300	39.27	36.52	15,730	13,693	727	748	229.52	36.6	-856	43.33
101		95B	95.2	30,300	30.03	34.33	15,730	14,094	673	712	234.49	99.7	-891	46.19
101		95B	95.4	30,300	27.72	16.07	15,173	12,572	706	734	225.55	75.5	-801	47.86
101		95B	96.0	30,300	41.58	44.56	16,147	14,334	673	757	231.51	41.2	-779	48.70
102		95B	145.2	30,400	23.87	26.03	14,895	13,293	718	723	233.50	86.1	651	52.05
102		95B	145.8	30,400	50.82	40.90	14,616	11,932	729	712	232.50	63.0	282	50.37
102		95B	146.6	30,400	25.41	23.37	15,034	12,973	751	734	232.50	54.9	-140	52.05
102		95B	147.2	30,300	29.26	17.53	15,451	12,492	740	734	229.52	43.1	-610	51.21
102		95B	147.9	30,300	18.48	23.37	14,755	12,572	706	712	233.50	27.1	-838	51.21

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
103	908	95B	157.1	30,700	16.17	21.91	14,338	13,053	706	734	234.49	96.2	648	49.53
103		95B	157.6	30,700	16.17	5.84	13,791	10,972	740	678	226.54	44.2	-306	47.86
103		95B	156.5	30,600	41.58	42.36	16,008	14,014	773	656	230.52	25.0	-1269	44.51
104		95B	194.4	21,200	19.25	22.64	14,616	12,893	684	689	233.50	82.3	-175	46.19
104		95B	195.0	21,100	35.42	9.50	14,755	11,051	773	712	222.57	45.2	-1062	42.84
104		95B	195.6	21,100	40.04	42.36	15,869	14,094	765	757	232.50	25.0	-1442	41.16
105		95B	208.9	27,900	26.16	27.03	15,312	13,453	695	723	237.47	70.1	209	47.02
105		95B	209.5	27,900	24.64	9.55	14,755	11,371	729	701	232.50	60.1	-993	42.84
105		95B	210.2	27,800	47.74	49.67	16,704	14,494	864	801	232.50	25.0	-1555	42.00
106		95B	212.4	20,300	26.18	27.76	15,173	13,373	664	701	236.48	70.1	132	45.35
106		95B	213.2	20,300	20.79	7.30	14,616	11,371	695	678	231.51	48.1	-1120	42.00
106		95B	213.6	20,300	31.57	26.50	15,312	13,293	705	712	232.50	25.0	-1407	41.16
107		96B	28.1	26,500	24.64	22.64	14,755	13,133	690	695	236.48	73.6	0	47.05
107		96B	28.5	26,500	24.64	13.15	14,616	11,772	735	707	232.50	46.3	-683	46.21
107		96B	29.1	26,500	44.66	40.90	16,287	14,094	768	745	232.50	29.2	-1325	42.86
108		96B	39.6	21,600	16.94	21.91	14,199	12,652	701	707	232.50	51.2	98	45.37
108		96B	40.0	21,600	21.56	12.42	14,616	11,772	679	685	231.51	74.3	-668	42.86
108		96B	40.6	21,500	52.36	20.45	16,008	12,412	848	762	222.57	25.0	-1405	41.19
108		96B	40.7	21,500	47.74	44.56	16,287	14,174	804	751	231.51	25.2	-1498	40.35
109		96B	98.7	30,500	24.64	25.57	15,312	13,373	690	707	236.48	82.7	-403	44.53
109		96B	99.1	30,500	28.49	4.38	14,895	11,531	712	718	232.50	44.7	-992	42.86
109		96B	99.6	30,500	20.02	22.64	14,755	13,293	701	796	234.49	25.0	-1291	42.02
110		96B	110.2	22,100	16.94	15.34	14,477	12,733	679	662	233.50	82.3	-343	43.70
110		96B	110.7	22,100	24.64	7.30	14,616	11,611	712	796	228.53	39.2	-992	42.86
110		96B	111.3	22,000	38.50	35.06	16,908	13,934	735	729	232.50	25.0	-1314	42.02
111		96B	114.3	21,900	16.94	18.99	14,616	13,213	665	673	236.48	82.1	-18	44.53
111		96B	114.7	21,900	24.64	7.30	14,755	11,611	690	796	232.50	34.2	-669	43.70
111		96B	115.3	21,900	43.89	37.25	16,147	13,133	768	740	231.51	27.2	-1119	42.86
112		96B	125.0	21,500	19.25	21.18	14,616	13,052	690	796	233.50	84.0	131	46.21
112		96B	125.8	21,500	20.79	10.23	14,616	11,692	679	673	230.52	57.9	-912	43.70
112		96B	126.3	21,500	40.04	38.71	16,147	14,094	746	729	232.50	27.2	-1257	42.02
113		98B	6.8	23,400	16.94	17.53	14,395	13,533	728	712	233.50	52.3	3541	81.55
113		98B	7.5	23,400	28.49	16.07	15,730	13,213	739	767	229.52	44.3	3120	79.91
113		98B	7.9	23,400	40.04	36.52	16,426	14,414	807	756	231.51	0.0	2788	76.64
114		02C	79.8	28,600	37.73	37.98	16,147	14,414	739	756	234.49	105.2	1182	75.00
114		02C	80.2	28,600	19.48	15.34	14,616	13,613	739	734	233.50	77.3	2165	74.18
114		02C	80.5	28,600	35.42	21.91	17,122	13,293	750	778	230.52	52.3	898	75.00
114		02C	80.7	28,600	26.18	22.64	14,895	13,293	806	767	229.52	30.0	894	75.82
115		02C	182.2	19,700	24.64	23.37	15,173	13,373	728	712	233.50	67.3	1312	74.18
115		02C	182.6	19,700	26.18	16.07	15,312	12,652	728	723	232.50	69.1	1021	73.37
115		02C	183.0	19,700	32.34	16.26	15,591	12,973	739	745	230.52	57.6	742	72.55
115		02C	183.6	19,700	38.50	32.87	16,287	14,014	750	767	232.50	50.2	577	71.73
116		03C	23.6	22,200	19.25	23.37	15,591	14,014	724	733	236.48	106.5	4449	84.09
116		03C	24.4	22,200	24.64	7.30	15,451	12,012	735	[illegible]	230.52	47.3	3110	81.64
116		03C	24.9	22,200	11.55	6.57	16,287	14,334	746	[illegible]	235.48	62.7	3142	80.82
117		03C	75.6	22,800	16.94	21.18	15,312	13,613	735	730	234.49	107.1	3091	80.00
117		03C	75.8	22,800	21.56	9.50	14,895	12,252	746	717	232.50	91.1	2097	79.18
117		03C	76.3	22,700	28.49	29.21	15,591	13,854	735	741	233.50	87.4	1400	77.55
117		03C	76.5	22,700	24.64	24.10	15,173	13,613	735	730	233.50	75.6	1377	77.55
117		03C	76.7	22,700	25.41	8.77	15,312	12,412	724	739	231.51	63.2	1200	76.73
117		03C	77.0	22,700	33.88	30.66	15,730	14,024	746	763	232.50	44.1	1064	76.73

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
118	908	03C	105.4	27,700	23.87	21.18	15,034	13,453	735	741	232.50	57.3	1343	77.55
118		03C	105.6	27,600	27.72	14.61	15,312	12,813	746	752	226.53	46.1	1173	77.55
118		03C	105.9	27,600	28.49	29.21	15,451	13,774	746	752	231.51	39.9	974	76.73
119		03C	136.2	22,300	20.02	23.37	14,895	13,613	735	719	234.49	104.3	3638	80.82
119		03C	136.7	22,300	17.71	8.77	14,338	11,692	724	70[illegible]	231.51	90.0	2699	79.18
119		03C	137.2	22,300	19.25	9.50	14,616	11,692	735	697	230.52	79.5	2076	77.55
119		03C	137.7	22,300	17.71	7.30	14,338	11,531	724	697	232.50	72.3	1061	73.45
119		03C	138.1	22,200	32.34	30.68	15,730	13,854	746	76[illegible]	232.50	47.3	624	72.64
120		03C	197.2	22,300	16.94	21.91	14,477	13,373	702	708	233.50	96.8	3980	80.82
120		03C	197.6	22,300	19.25	7.30	14,338	12,012	713	697	231.51	87.6	3528	80.00
120		03C	198.5	22,300	26.95	14.61	15,451	12,572	724	752	230.52	80.5	1910	73.45
120		03C	199.4	22,200	44.66	50.40	16,426	14,494	813	774	232.50	30.6	466	70.18
121		03C	258.3	22,300	31.57	34.33	15,730	14,014	724	741	232.50	102.3	3605	78.36
121		03C	258.9	22,300	29.26	9.50	15,312	12,252	713	741	230.52	80.2	2528	77.55
121		03C	259.2	22,300	20.79	11.69	14,755	12,012	724	719	230.52	79.5	1610	73.45
121		03C	260.5	22,200	22.33	29.21	16,147	13,854	746	763	231.51	30.6	561	69.36
122		03C	308.9	22,700	34.65	34.33	16,287	14,414	713	697	236.48	95.6	7960	93.09
122		03C	309.6	22,700	23.10	8.77	15,312	12,492	702	686	232.50	100.3	6630	93.09
122		03C	310.1	22,700	26.95	24.83	16,287	14,014	713	666	233.50	103.2	6014	89.82
123		04C	25.9	23,900	21.56	22.64	15,173	13,613	732	738	234.49	84.1	2585	88.00
123		04C	26.4	23,900	28.49	17.53	15,869	13,213	732	771	232.50	69.1	1967	85.55
123		04C	26.8	23,900	28.49	29.21	15,730	13,934	754	760	232.50	39.2	1684	83.91
124		05C	92.0	21,800	20.79	23.37	14,895	13,533	714	720	233.50	83.4	3287	90.82
124		05C	92.4	21,800	23.10	13.15	14,895	12,733	725	731	230.52	72.1	2623	89.18
124		05C	92.7	21,800	24.64	17.53	14,895	12,813	725	742	230.52	55.0	2310	88.36
124		05C	93.2	21,700	24.64	37.25	15,312	14,414	714	753	231.51	33.4	1966	87.55
125		08C	29.0	22,000	21.56	18.99	14,895	13,293	748	709	235.48	62.3	2553	82.43
125		08C	29.3	22,000	26.18	9.50	15,451	12,172	737	731	233.50	30.5	1976	81.65
125		08C	29.6	22,000	31.57	29.21	15,591	13,854	748	753	234.49	17.7	1842	82.43
126		08C	58.9	29,000	9.47	18.99	14,616	13,453	715	720	234.49	80.5	3106	79.30
126		08C	59.2	29,000	13.09	4.38	13,781	11,371	726	698	232.50	56.9	2460	76.96
126		08C	60.0	29,000	45.43	44.56	16,426	14,895	782	786	234.49	0.0	1278	73.83
127		08C	68.2	21,900	17.71	18.99	14,616	13,373	715	709	234.49	78.6	2774	77.74
127		08C	68.6	21,900	10.01	0.00	13,503	11,291	726	687	232.50	57.7	2056	75.39
127		08C	69.2	21,900	36.19	32.14	16,147	14,334	715	764	234.49	0.0	1171	73.04
128		08C	107.4	22,400	15.40	17.53	14,199	13,373	715	698	235.48	74.3	1873	73.04
128		08C	107.9	22,400	18.48	8.03	14,059	12,012	737	709	232.50	20.5	1135	68.35
128		08C	108.3	22,400	23.10	25.57	15,034	13,934	737	753	238.46	0.0	821	67.57
129		09C	32.5	26,900	15.40	16.07	14,477	13,213	705	699	239.46	96.1	1554	69.30
129		09C	32.9	26,900	30.03	10.23	15,034	12,492	749	721	233.50	22.7	1269	70.09
129		09C	33.3	26,800	33.88	14.61	16,008	13,934	738	754	233.50	44.2	1363	70.09
129		09C	33.7	26,800	33.88	27.76	16,008	13,934	760	743	235.48	4.1	983	70.09
130		09C	51.5	22,600	16.17	16.80	14,059	13,293	705	699	235.48	77.2	146.	69.30
130		09C	51.8	22,600	19.25	8.77	14,755	12,172	772	710	233.50	53.1	1169	68.52
130		09C	52.1	22,500	32.34	29.94	15,869	13,854	727	754	234.49	30.5	962	68.52
131		09C	159.5	21,600	23.87	26.30	15,034	13,774	727	721	236.48	100.3	1058	63.04
131		09C	160.0	21,500	23.10	5.11	14,755	11,692	760	732	229.52	39.2	477	62.26
131		09C	160.5	21,500	49.28	44.56	16,565	15,055	783	766	238.46	0.0	197	59.91

TABLE I - contd.

Sample No	Acft No	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Air-speed (kn)	Density Alt (ft)	Outside Air Temp (°F)
132	908	09C	220.4	19,300	19.25	21.18	14,755	13,693	705	699	234.49	91.9	1665	63.04
132		09C	220.8	19,300	19.25	6.57	14,616	12,012	716	688	232.50	65.3	677	59.91
132		09C	221.2	19,300	20.79	22.64	14,895	13,854	716	710	237.47	53.1	370	58.35
133		09C	282.9	22,100	20.79	17.53	14,895	12,973	727	688	235.48	90.2	926	58.35
133		09C	283.3	22,100	29.26	8.03	15,312	12,172	749	743	232.50	63.1	508	58.35
133		09C	283.8	22,000	30.03	24.10	15,730	13,774	738	754	235.48	30.5	197	56.78
134		10C	233.0	22,500	3.08	0.00	11,971	10,891	755	727	245.42	87.2	3436	66.43
134		10C	233.5	22,500	23.87	4.38	14,755	11,451	800	738	229.52	96.1	2585	71.91
134		10C	234.4	22,500	34.65	30.68	16,008	14,574	744	749	235.48	108.3	1191	71.91
135		11C	59.4	20,900	30.03	27.76	15,173	13,774	785	734	235.48	65.5	1027	64.00
135		11C	59.6	20,900	35.42	18.99	15,451	13,453	829	756	229.52	63.2	854	64.00
135		11C	60.0	20,900	26.18	22.64	15,034	13,693	765	723	235.48	52.4	562	63.22
136		12C	50.2	24,900	20.02	11.69	14,755	12,172	711	661	232.50	72.2	2966	63.33
136		12C	50.7	24,900	12.32	0.00	13,503	10,891	706	661	231.51	62.7	1994	62.65
136		12C	51.0	24,900	16.17	0.73	14,059	10,971	706	672	229.52	46.1	1120	59.52
136		12C	51.5	24,800	27.72	22.64	15,173	13,693	634	750	234.49	38.3	431	57.17
137		12C	97.4	24,700	24.64	22.64	15,451	13,854	700	705	235.48	92.6	3440	62.65
137		12C	97.9	24,600	23.87	12.42	15,034	12,252	634	716	227.53	57.3	2613	61.87
137		12C	98.4	24,600	45.43	44.56	16,565	15,215	623	772	234.49	18.1	2185	59.52
138		18C	96.2	24,000	40.04	31.41	16,287	14,494	765	793	235.48	75.6	3803	91.45
138		18C	96.7	24,000	21.56	9.50	15,173	12,813	765	759	234.49	61.6	3288	90.64
138		18C	97.6	23,900	20.02	27.76	15,451	13,854	798	793	234.49	18.6	2065	83.27
139		18C	222.0	22,600	19.25	28.49	16,008	14,414	754	826	241.44	67.2	5801	98.82
139		18C	222.9	22,600	17.71	5.11	14,895	12,092	743	737	236.48	45.3	4119	95.55
139		18C	223.6	22,600	39.27	37.25	16,426	14,494	820	804	234.49	[illegible]	2910	91.45
140		18C	230.3	22,300	20.02	25.57	15,173	13,613	743	748	235.48	98.7	4089	93.09
140		18C	231.2	22,200	20.79	0.00	14,895	11,131	798	726	228.53	57.7	2243	88.18
140		18C	231.6	22,200	48.51	37.25	17,679	14,494	900	815	233.50	0.0	1984	84.91
141		18C	247.6	21,500	26.95	27.03	15,451	13,774	743	759	234.49	96.2	3103	88.18
141		18C	246.3	21,500	21.56	0.00	15,312	11,451	754	770	227.53	44.2	2169	87.36
141		18C	248.6	21,500	37.73	37.25	16,565	14,494	787	792	233.50	13.2	1984	84.91
142	914	10B	2.0	22,800	22.20	26.00	13,956	13,322	683	731	234.17	79.9	6276	78.43
142		10B	3.3	22,800	24.30	8.40	12,950	11,226	683	753	224.71	35.6	6253	75.80
142		10B	3.9	22,700	37.40	41.30	15,339	14,294	758	800	231.81	13.1	5739	75.00
143		10B	21.8	24,700	29.10	34.40	13,830	13,621	683	731	234.17	83.1	6979	86.14
143		10B	22.2	24,700	69.30	0.00	15,339	6,736	893	777	222.35	69.4	7554	87.86
143		10B	25.2	24,600	69.30	0.00	14,082	8,382	882	903	229.44	77.3	7062	88.71
143		10B	25.9	24,600	28.40	35.20	13,705	13,546	672	720	232.99	80.6	6982	87.86
144		11B	0.0	27,300	5.50	22.20	12,447	13,172	644	763	237.72	0.0	5467	73.00
144		11B	0.4	27,300	36.00	62.70	14,333	15,118	767	878	234.17	67.7	5685	73.86
144		11B	0.9	27,300	43.70	46.60	13,705	13,995	756	798	230.81	84.1	3235	74.71
145		16B	42.5	21,700	22.18	5.35	13,202	11,001	682	730	225.90	15.1	5448	98.56
145		16B	42.6	21,700	29.11	13.75	13,579	11,301	694	742	223.53	0.0	5398	97.72
145		16B	42.9	21,700	29.11	16.05	14,082	12,349	719	788	232.99	0.0	5325	96.88
146		16B	63.3	20,600	15.94	39.75	14,208	13,621	694	715	232.99	103.0	6383	99.40
146		16B	64.1	20,600	8.32	30.58	12,573	13,471	645	754	232.99	[illegible]	5724	97.72
146		16B	64.7	20,600	45.71	2.29	14,333	10,103	815	754	218.80	29.6	5421	96.88
146		16B	65.3	20,500	15.25	30.58	12,825	13,322	694	766	228.26	9.7	5296	94.37

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
147	914	17B	33.9	22,800	24.95	30.58	13,956	12,798	675	715	229.44	89.6	4760	82.84
147		17B	34.7	22,800	31.88	6.88	14,082	11,301	700	761	221.16	54.9	3878	82.09
147		17B	36.3	22,700	48.82	48.16	14,711	14,220	812	807	229.44	11.2	3268	81.16
148		17B	51.8	22,100	36.73	50.52	14,208	13,696	700	726	232.99	95.3	4755	81.16
148		17B	53.6	22,000	36.04	48.16	14,082	13,621	725	772	224.71	3.5	2886	76.14
148		17B	53.8	22,000	48.82	51.99	14,585	14,369	812	839	227.08	9.7	2852	74.47
149		17B	66.5	21,500	37.43	42.05	14,333	13,845	712	750	230.63	13.4	4131	79.49
149		17B	67.6	21,500	33.96	14.53	13,956	11,900	700	750	221.16	52.3	3302	78.65
149		17D	68.3	21,500	44.36	45.11	14,333	14,145	775	796	228.26	19.2	2879	76.98
150		17B	78.5	26,100	37.43	41.28	14,208	13,920	712	738	232.99	34.2	4027	77.81
150		17B	79.6	26,100	27.03	9.17	13,202	11,301	675	715	222.35	50.2	3421	78.65
150		17B	80.5	26,000	38.81	32.23	14,333	13,845	737	761	232.99	3.5	2751	75.30
151		17B	90.4	25,600	38.81	43.58	14,208	13,920	737	772	231.81	34.2	7741	78.65
151		17B	91.5	25,600	48.52	20.64	14,208	12,349	725	722	222.35	9.7	2957	76.14
151		17B	92.0	25,600	25.64	23.70	13,328	12,972	675	715	232.99	9.7	2611	71.95
152		17B	104.1	20,100	57.53	63.45	15,213	14,968	889	865	232.99	64.2	3105	71.12
152		17B	105.2	20,100	49.90	44.34	15,088	14,294	877	807	232.99	77.2	4505	75.30
152		17B	105.5	20,100	39.51	50.52	15,213	13,995	775	761	232.99	27.1	4635	77.81
153		17B	106.5	20,000	32.58	32.11	14,208	13,471	700	715	232.99	22.9	4655	80.33
153		17B	107.5	20,000	32.58	9.94	13,956	11,301	712	738	225.90	59.7	3179	77.81
153		17B	108.5	20,000	49.21	48.16	15,088	14,369	825	818	234.17	0.0	2234	70.28
154		18B	33.6	21,600	33.96	38.23	14,208	13,696	724	735	231.81	103.9	4068	79.84
154		18B	34.4	21,600	37.43	17.58	14,333	12,049	774	792	222.35	53.4	3296	78.16
154		18B	35.1	21,600	39.51	48.16	14,208	14,220	749	815	232.99	32.1	3033	75.65
155		18B	35.8	24,100	40.89	51.22	14,208	14,294	761	838	230.63	0.0	2936	75.65
155		18B	36.2	24,000	83.17	74.16	15,842	15,118	935	894	230.63	35.8	3044	75.65
155		18B	37.0	24,000	53.37	58.87	15,088	14,594	861	849	234.17	60.2	3869	78.16
156		18B	83.0	21,800	36.73	39.75	14,333	13,920	737	872	234.17	103.0	4644	74.81
156		18B	83.8	24,700	31.88	48.16	13,830	11,825	699	735	228.26	61.5	3403	71.47
156		18B	84.4	24,700	24.26	23.70	13,453	12,872	674	735	230.63	46.1	2897	68.95
157		25B	32.9	23,900	35.35	38.23	14,208	13,696	712	746	231.81	91.1	7218	100.77
157		25B	34.5	23,900	25.64	6.12	13,076	10,852	662	712	224.71	51.6	6696	99.93
157		25B	35.1	23,900	31.19	6.88	13,579	11,001	687	724	222.35	29.2	5962	98.26
157		25B	35.7	23,800	33.96	32.11	13,956	13,322	723	735	225.90	0.0	5437	94.91
158		25B	42.1	25,200	45.74	45.87	14,711	14,294	824	815	232.99	14.5	5030	90.72
158		25B	42.7	25,200	10.40	71.10	15,716	15,118	923	896	234.17	33.6	5103	90.72
158		25B	44.5	25,100	56.14	55.81	15,213	14,667	898	850	234.17	73.5	6084	98.26
159		25B	142.7	23,900	42.97	48.16	14,711	14,294	799	815	234.17	57.9	3965	92.40
159		25B	143.3	23,900	36.04	21.40	14,333	13,995	762	780	234.17	73.5	4412	95.74
159		25B	144.0	23,800	29.11	31.34	14,208	13,621	723	735	235.36	79.9	4540	94.91
160		27B	16.1	22,300	35.35	50.52	14,836	14,145	777	782	234.17	77.3	5210	66.21
160		27B	16.5	22,300	27.03	18.35	13,956	13,471	715	713	234.17	79.8	5505	67.88
160		27B	17.7	22,300	23.57	8.41	14,082	13,546	703	701	234.17	79.8	5456	68.72
160		27B	18.7	22,200	33.27	38.99	14,333	13,845	715	757	234.17	94.2	5531	67.88
161		27B	20.1	22,200	35.35	50.52	14,459	13,920	752	770	234.17	112.1	5479	67.05
161		27B	20.9	22,100	32.58	11.47	14,208	13,546	703	689	232.99	98.9	5352	67.05
161		27B	21.6	22,100	36.04	32.87	14,082	13,546	703	701	234.17	103.0	5135	67.88
162		37B	21.9	23,600	36.04	50.52	14,459	14,145	769	996	234.17	0.0	833	60.65
162		37B	23.0	22,100	66.54	61.92	15,465	14,893	871	1046	244.82	107.5	3426	68.19
162		37B	24.7	22,000	54.06	56.57	15,339	14,669	834	1035	234.17	111.2	6085	76.56

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
163	914	37B	33.9	21,700	29.11	32.87	14,208	13,696	672	915	234.17	108.6	7479	79.07
163		37B	34.7	21,700	15.25	0.76	12,825	10,403	623	904	231.81	95.0	5612	76.56
163		37B	35.7	21,600	24.95	7.65	13,202	12,124	660	950	224 71	53.3	3801	78.23
163		37B	36.3	21,600	34.66	46.63	14,208	14,369	722	1008	234.17	0.0	2949	69.02
164		37B	53.9	22,300	31.88	39 75	14,459	14,145	722	996	234.17	99.1	4265	73.21
164		37B	54.6	22,300	28.42	31.34	14,333	13,995	710	962	232.99	99.1	4302	73.21
164		37B	56.2	22,200	30.50	13.76	14,459	13,920	710	950	232 99	101.8	4240	73.21
164		37B	57.3	22,200	31.88	33.64	14,459	13,696	722	925	234.17	108.6	4191	73.21
165		37B	186.0	26,100	36.04	42.05	14,711	14,220	734	996	234 17	99.2	3827	70.70
165		37B	186.5	26,100	34.12	17.58	14,459	13,920	710	950	234.17	107.0	3750	69.86
165		37B	187.2	26,100	29.11	37.46	14,459	13,845	697	938	234.17	100.4	3600	69.02
166		38B	2.3	22,900	27 72	32 11	13,956	13,546	677	689	234.17	112.1	2940	54.33
166		38B	3.3	22,900	19.41	6.12	12,950	11,151	640	689	228.26	62.1	2323	55.16
166		38B	3.6	22,800	42.97	25.99	14,585	13,622	727	769	223.53	28.9	2081	55.16
167		38B	87.8	24,200	30 50	32.87	14,208	13,621	659	669	234.17	119.5	3138	54.33
167		38B	88.9	24,200	24.95	11.47	13,830	12,049	652	669	229.44	89.2	1736	52.65
167		38B	90.0	24,200	37.43	39.75	14,459	13,920	739	746	228.26	18.8	453	50.14
168		38B	95.4	23,900	28.42	31.34	14,082	13,546	701	689	234.17	103.9	2554	53.49
168		38B	96.3	23,900	21.49	8.41	13,202	11,376	652	689	231.81	67.8	1318	50.14
168		38B	97.0	23,900	50.60	39.75	14,459	13,995	782	769	223.54	29.3	594	50.14
169		38B	125.8	23,300	20.10	25.23	13,830	13,247	652	689	232.99	67.4	1958	51.81
169		38B	126.8	23,200	27.03	9.94	13,453	11,525	652	701	225.89	61.3	934	50.98
169		38B	127.5	23,200	37.43	36.70	14,333	13,621	727	701	229.44	20.3	350	49.30
170		38B	132.2	21,800	21.49	24.46	13,453	13,022	564	701	231.81	104.2	3287	52.65
170		38B	133.7	21,800	20.10	6.12	13,202	11,301	652	689	227.08	46 0	1278	50.98
170		38B	134.4	21,800	45.74	28.29	14,459	13,172	776	769	222.35	25.0	500	50.14
171		38B	158.0	21,000	29.11	32.87	14,208	13,621	677	677	234.17	119.8	4237	56.84
171		38B	159.9	21,000	26 34	10.70	13,830	11,974	664	701	225.53	67.7	2238	53.49
171		38B	160.6	21,000	47.13	46.63	14,585	13,995	764	746	229.44	30.4	1887	53.49
172		38B	173.9	22,500	0.00	95.56	126	15,866	180	1137	231.81	8.9	301	50.14
172		38B	174.3	22,500	0.00	105.50	126	15,866	155	1163	226.26	29.4	407	50.14
172		38B	175.5	22,400	0.00	101.68	251	15,941	105	1160	223.53	81.2	556	47.63
173		38B	176.7	22,300	0.00	71.10	126	15,118	80	1068	232.99	73.2	1219	50.98
173		38B	177.5	22,300	0.00	74.16	126	15,342	85	1037	232.99	66.3	1350	50.98
173		38B	178.4	22,300	0.00	74.16	251	15,417	69	1079	231.81	68.0	1477	51.81
174		38B	187.2	21,900	0.00	74.92	126	15,267	130	1057	231.81	85.9	3068	55.16
174		38B	188.4	21,900	0.00	75.69	126	15,342	142	1068	231.81	82.0	3308	56.00
174		38B	189.5	21,900	0.00	76.45	126	15,342	117	1079	231.81	80.0	3480	56.84

TABLE I - contd.

Sample No.	Acft No.	Flt No.	Time (min)	Gross Wt (lb)	Torque (pct) 1	Torque (pct) 2	Gas Producer RPM 1	Gas Producer RPM 2	Exhaust Gas Temp (°F) 1	Exhaust Gas Temp (°F) 2	Main Rotor RPM	Airspeed (kn)	Density Alt (ft)	Outside Air Temp (°F)
175	914	38B	193.2	21,700	0.00	55.81	126	14,743	130	1034	234.17	78.9	3693	58.51
175		38B	194.9	21,700	0.00	78.74	251	15,417	130	1092	228.26	22.7	2973	57.67
175		38B	195.5	21,600	0.00	103.21	126	15,941	142	1160	211.70	0.0	2826	57.67
176		38B	195.7	21,600	0.00	104.74	126	15,866	142	1163	211.70	0.0	2657	56.00
176		38B	196.0	21,600	0.00	103.21	126	15,866	130	1183	211.70	0.0	2681	56.00
176		38B	196.6	21,600	0.00	65.77	377	15,716	130	1103	238.91	0.0	2760	56.87
177		56B	1.3	22,100	26.34	39.75	13,830	13,771	828	755	235.36	76.2	4172	86.43
177		56B	1.8	22,000	9.70	2.29	12,196	11,451	817	[illegible]	234.17	31.2	3728	85.57
177		56B	2.3	22,000	32.58	34.40	14,082	13,771	825	765	232.99	0.0	3622	85.57
178		57B	70.1	19,000	36.73	35.17	14,208	13,771	924	862	231.81	102.1	4992	80.83
178		57B	72.0	19,000	20.10	7.65	12,950	11,226	775	747	225.90	0.0	3417	79.16
178		57B	72.4	18,900	36.73	45.87	14,082	14,145	837	805	230.63	0.0	3138	80.00
179		57B	82.2	21,700	58.22	45.87	14,585	14,070	887	794	229.44	0.0	4713	81.67
179		57B	82.5	21,700	59.61	45.87	14,836	14,220	912	805	232.99	93.2	4519	81.67
179		57B	83.2	21,700	48.52	49.69	14,836	14,369	862	817	232.99	101.8	5176	80.83
180		57B	122.9	20,200	41.59	39.75	14,208	14,070	812	758	232.99	109.1	5648	81.67
180		57B	123.8	20,100	30.50	12.23	12,825	11,226	775	747	221.16	0.0	4955	60.83
180		57B	124.1	20,100	29.80	29.05	13,830	13,471	801	747	231.81	0.0	4672	80.00
181		57B	125.2	20,100	40.89	36.70	14,585	14,070	850	794	234.17	78.2	5386	80.83
181		57B	125.6	20,100	20.10	6.88	12,950	11,675	775	758	230.63	0.0	5399	80.83
181		57B	126.9	20,000	49.90	39.75	14,836	13,920	887	794	231.81	106.5	4574	80.00
182		57B	153.3	21,100	13.17	11.47	12,573	12,199	701	701	232.99	77.3	7835	89.21
182		57B	154.3	21,100	24.26	12.23	13,202	12,274	775	770	227.08	59.5	6113	84.19
182		57B	155.4	21,000	24.26	26.76	13,453	13,396	786	758	231.81	0.0	5351	81.67
183		58B	0.1	23,000	75.55	64.98	15,213	14,594	910	813	231.81	107.0	266	54.85
183		58B	1.1	23,000	74.85	64.98	15,591	14,968	985	846	232.99	91.7	2598	52.29
183		58B	2.3	22,900	31.88	35.93	14,082	13,845	811	756	232.99	90.3	4782	57.43
184		58B	15.7	25,900	41.59	42.05	14,585	14,145	844	779	231.81	59.1	5250	59.14
184		58B	17.0	25,800	20.10	1.53	12,825	10,103	737	687	227.08	51.3	4613	54.00
184		58B	17.1	25,800	24.95	10.70	12,825	11,600	748	720	231.81	48.1	2029	54.00
185		60B	18.3	22,200	34.66	53.52	14,208	14,893	821	846	234.17	0.0	2291	69.14
185		60B	20.0	22,100	61.69	49.69	15,213	14,519	920	813	232.99	95.6	4031	75.14
185		60B	20.6	22,100	61.69	49.69	15,339	14,519	950	813	232.99	104.1	5134	77.71
186		61B	55.4	26,200	72.06	57.34	15,339	14,145	971	671	232.99	0.0	3336	77.86
186		61B	55.7	26,200	69.31	67.28	15,464	15,043	995	904	232.99	15.1	3467	77.86
186		61B	56.5	26,200	59.61	56.5[illegible]	14,836	14,594	896	836	232.99	104.1	4097	81.29

TABLE II. INVESTIGATION OF CH-47A HELICOPTER ENGINE LOAD SHARING (INSTRUMENTATION INCOMPLETE)

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
1	908	2A	7.7	48.51	29.21	A
1	908	2A	8.1	66.99	48.21	A
1	908	2A	8.6	58.52	50.40	A
1	908	2A	9.4	48.51	43.10	A
2	908	2A	14.6	49.28	35.06	S
2	908	2A	15.4	20.79	48.21	S
2	908	2A	16.4	36.19	33.60	S
3	908	3A	7.6	30.80	21.91	D
3	908	3A	8.4	23.10	13.15	D
3	908	3A	9.0	[illegible].24	6.57	D
3	908	3A	9.7	27.72	11.69	D
4	908	4A	1.2	26.95	22.64	S
4	908	4A	1.9	[illegible]	41.63	S
4	908	4A	2.7	[illegible].78	40.90	S
5	908	7A	68.6	26.95	8.77	D
5	908	7A	69.5	26.95	14.61	D
5	908	7A	70.7	40.04	39.44	D
6	908	16A	1[illegible].9	36.19	37.98	S
6	908	16A	20.5	21.56	6.57	D
6	908	16A	21.9	28.49	22.64	D
7	908	17A	17.4	34.65	35.79	D
7	908	17A	19.0	21.56	8.77	D
7	908	17A	20.4	31.57	13.88	D
7	908	17A	21.6	42.35	32.87	D
8	908	17A	40.8	54.67	52.59	A
8	908	17A	43.0	46.20	27.76	D
8	908	17A	44.2	50.82	47.48	A
9	908	17A	62.2	31.57	27.76	S
9	908	17A	63.2	36.96	21.18	D
9	908	17A	64.1	23.87	7.30	D
10	908	17A	65.3	34.65	32.14	A
10	908	17A	66.5	23.10	6.57	D
10	908	17A	67.1	49.28	32.14	D
11	908	18A	23.8	49.28	47.48	S
11	908	18A	24.5	29.26	25.57	S
11	908	18A	25.8	40.81	37.98	S
12	908	18A	29.1	36.96	33.60	D
12	908	18A	30.2	27.72	8.77	D
12	908	18A	32.3	47.74	40.17	D

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
13	908	18A	54.1	27.72	23.37	D
13	908	18A	55.6	7.70	0.00	D
13	908	18A	57.1	62.37	54.78	D
14	908	18A	64.3	29.26	27.03	S
14	908	18A	65.2	20.02	6.57	D
14	908	18A	66.1	11.55	7.30	D
15	908	18A	68.3	39.27	35.79	D
15	908	18A	76.2	39.27	39.44	S
15	908	18A	79.4	29.26	10.96	D
15	908	18A	80.8	56.21	46.01	D
16	908	18A	120.4	31.57	29.21	S
16	908	18A	122.2	23.87	9.50	D
16	908	18A	123.4	46.20	40.17	D
17	908	18A	124.1	64.68	58.43	A
17	908	18A	126.9	33.88	20.45	D
17	908	18A	127.2	39.27	34.33	D
18	908	19A	29.4	21.56	33.60	A
18	908	19A	29.6	62.37	68.66	A
18	908	19A	30.6	43.89	46.75	A
19	908	19A	52.0	27.72	29.21	D
19	908	19A	59.5	8.47	3.65	D
19	908	19A	60.2	31.57	14.61	D
20	908	19A	82.6	30.80	29.21	D
20	908	19A	83.6	0.00	38.71	D
20	908	19A	84.7	50.82	47.48	D
21	908	19A	89.4	50.05	41.63	D
21	908	19A	89.9	13.86	3.65	D
21	908	19A	91.4	29.26	3.65	D
22	908	19A	110.3	44.66	43.83	D
22	908	19A	111.7	21.56	9.50	D
22	908	19A	112.5	75.46	66.47	D
23	908	19A	131.9	26.95	18.99	D
23	908	19A	132.3	21.56	7.30	D
23	908	19A	133.5	36.19	16.80	D
24	908	20A	8.6	34.65	33.60	D
24	908	20A	10.2	23.88	8.03	D
24	908	20A	10.4	42.35	21.91	D
25	908	20A	44.9	31.57	26.30	D
25	908	20A	45.6	29.26	8.77	D
25	908	20A	46.9	46.91	36.52	D

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
26	908	20A	73.0	34.65	31.41	D
26	908	20A	74.5	22.33	7.30	D
26	908	20A	75.6	39.27	32.14	D
27	908	20A	84.8	42.35	39.44	D
27	908	20A	86.4	29.26	2.19	D
27	908	20A	87.7	52.36	36.52	D
28	908	21A	13.9	39.27	39.44	S
28	908	21A	14.3	70.84	0.00	S
28	908	21A	15.3	62.37	10.96	S
29	908	21A	36.7	26.95	22.64	D
29	908	21A	37.4	21.56	8.03	D
29	908	21A	38.1	22.33	6.77	D
30	908	21A	97.3	36.96	33.60	D
30	908	21A	98.4	13.09	0.00	D
30	908	21A	98.9	36.19	16.80	D
31	908	22A	50.8	28.49	21.30	D
31	908	22A	51.6	0.00	43.83	D
31	908	22A	52.6	18.48	4.38	D
32	908	23A	7.3	33.88	29.94	D
32	908	23A	8.5	18.48	6.57	D
32	908	23A	10.1	40.81	38.71	D
33	908	23A	23.2	23.10	21.91	D
33	908	23A	24.1	23.87	13.15	D
33	908	23A	24.9	14.63	7.30	D
33	908	23A	25.9	30.80	14.61	D
34	908	23A	73.5	33.80	26.30	D
34	908	23A	75.2	39.27	4.38	D
34	908	23A	75.6	34.65	31.41	D
35	908	23A	77.7	33.88	46.01	H
35	908	23A	78.4	39.27	48.21	H
35	908	23A	78.7	34.65	42.36	H
36	908	23A	138.8	33.88	27.76	D
36	908	23A	139.9	23.10	6.03	D
36	908	23A	141.4	11.55	4.38	D
37	908	23A	198.1	37.73	37.25	D
37	908	23A	199.6	26.18	7.30	D
37	908	23A	199.9	23.10	24.10	D
37	908	23A	201.7	28.47	33.60	D

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.						
Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	2	Flight Condition*
38	914	42A	8.1	27.72	35.17	M
38	914	42A	8.5	0.00	12.23	M
38	914	42A	9.0	38.81	42.81	M
38	914	42A	9.8	6.93	27.52	M
39	914	42A	11.5	17.33	27.52	D
39	914	42A	11.9	0.69	22.94	D
39	914	42A	12.5	39.51	23.70	D
40	914	43A	8.4	18.02	16.05	D
40	914	43A	8.9	17.33	4.59	D
40	914	43A	9.4	35.35	19.11	D
41	914	44A	1.8	56.16	44.34	A
41	914	44A	5.3	36.04	47.40	A
41	914	44A	7.1	35.35	41.28	A
42	914	44A	27.0	76.24	58.10	A
42	914	44A	27.2	72.78	63.45	A
42	914	44A	27.6	49.90	58.10	A
43	914	44A	49.8	45.05	49.69	S
43	914	44A	50.7	51.[illegible]	46.63	S
43	914	44A	51.6	32.58	49.69	S
44	914	45A	14.7	60.99	28.29	A
44	914	45A	14.9	27.03	21.40	A
44	914	45A	15.1	51.98	40.52	A
45	914	45A	27.6	15.25	25.23	D
45	914	45A	28.5	0.00	19.88	D
45	914	45A	29.6	40.20	35.93	D
46	914	46A	10.7	39.51	36.70	S
46	914	46A	11.1	0.00	42.81	S
46	914	46A	11.6	39.51	45.87	S
47	914	46A	15.8	9.70	9.17	D
47	914	46A	16.7	41.59	18.35	D
47	914	46A	17.1	51.98	40.52	D
48	914	46A	17.4	50.60	25.23	H
48	914	46A	17.8	51.29	43.58	H
48	914	46A	18.1	49.90	54.28	H
49	914	46A	41.4	77.63	58.10	A
49	914	46A	41.7	65.84	50.46	A
49	914	46A	42.2	37.43	42.81	A
50	914	46A	42.4	36.04	42.81	D
50	914	46A	42.8	0.69	17.58	D
50	914	46A	43.2	38.12	39.75	D
51	914	47A	11.0	41.59	31.34	H
51	914	47A	11.2	48.52	38.99	H
51	914	47A	11.7	0.00	50.46	H

*D - Descent; S - Steady, A Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
52	914	47A	11.7	76.24	64.98	A
52	914	47A	12.0	67.23	65.77	A
52	914	47A	12.4	62.38	64.98	A
53	914	50A	2.9	49.90	45.11	D
53	914	50A	3.3	7.62	68.04	D
53	914	50A	4.1	46.44	55.04	D
54	914	50A	37.4	55.45	68.81	S
54	914	50A	38.1	58.22	62.69	S
54	914	50A	38.6	40.20	47.40	S
55	914	50A	79.5	2.08	25.23	D
55	914	50A	80.2	43.67	49.69	D
55	914	50A	80.2	40.89	45.11	D
56	914	51A	0.1	71.39	48.16	A
56	914	51A	0.4	49.21	52.75	A
56	914	51A	0.6	22.67	37.46	A
57	914	51A	2.4	29.80	39.75	S
57	914	51A	2.4	29.80	38.99	S
57	914	51A	2.5	22.83	34.40	S
58	914	51A	4.6	20.10	29.05	D
58	914	51A	4.6	77.63	64.98	D
58	914	51A	4.6	40.20	42.05	D
59	914	51A	7.8	29.11	37.46	D
59	914	51A	7.8	76.93	64.98	D
59	914	51A	7.9	48.52	50.46	D
60	914	51A	8.0	18.71	27.52	D
60	914	51A	8.1	6.93	29.05	D
60	914	51A	8.1	44.36	45.11	D
61	914	51A	8.5	41.59	49.69	S
61	914	51A	8.6	0.00	71.10	S
61	914	51A	8.7	0.00	93.27	S
61	914	51A	8.8	0.00	100.15	S
62	914	51A	8.8	0.00	91.74	D
62	914	51A	8.9	0.00	25.23	D
62	914	51A	9.0	0.00	16.82	D
62	914	51A	9.1	0.00	29.82	D
63	914	51A	9.5	40.20	54.28	S
63	914	51A	9.6	42.97	35.93	S
63	914	51A	9.7	38.81	35.93	S
64	914	51A	10.0	18.71	21.40	D
64	914	51A	10.0	71.39	50.46	D
64	914	51A	12.7	43.67	37.46	D

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
65	914	52A	0.1	72.78	60.40	A
65	914	52A	0.5	61.69	57.34	A
65	914	52A	0.8	39.51	47.40	A
66	914	52A	1.3	32.58	42.05	D
66	914	52A	1.8	13.86	35.17	D
66	914	52A	2.3	1.39	14.53	D
66	914	52A	2.5	43.67	42.81	D
67	914	52A	2.8	8.32	60.40	A
67	914	52A	3.1	36.04	37.46	A
67	914	52A	3.4	20.10	25.23	A
68	914	52A	3.6	18.71	29.82	D
68	914	52A	3.9	9.01	24.46	D
68	914	52A	4.1	47.13	41.28	D
69	914	52A	18.4	26.34	35.17	D
69	914	52A	18.7	13.86	33.64	D
69	914	52A	19.3	78.32	68.04	D
70	914	52A	20.1	74.16	65.77	A
70	914	52A	20.4	67.23	64.98	A
70	914	52A	20.8	41.59	56.10	A
71	914	52A	31.0	35.35	37.46	D
71	914	52A	31.6	4.16	16.82	D
71	914	52A	32.4	49.90	42.81	D
72	914	52A	32.6	76.93	61.16	A
72	914	52A	32.9	48.52	62.69	A
72	914	52A	33.4	45.74	52.75	A
73	914	52A	42.9	11.09	23.70	D
73	914	52A	43.7	33.96	35.17	D
73	914	52A	44.2	7.62	19.11	D
73	914	52A	45.1	69.31	55.04	D
74	914	52A	59.2	24.95	32.11	D
74	914	52A	59.6	8.32	23.70	D
74	914	52A	60.4	53.37	13.00	D
75	914	52A	60.6	78.32	71.10	A
75	914	52A	61.1	51.29	61.92	A
75	914	52A	61.7	29.80	45.87	A
76	914	52A	62.1	27.03	42.81	D
76	914	52A	62.5	11.09	26.76	D
76	914	52A	63.3	74.16	50.46	D
77	914	53A	10.7	22.87	32.11	D
77	914	53A	11.0	5.54	29.82	D
77	914	53A	11.5	6.24	17.58	D
78	914	53A	32.9	19.41	32.11	D
78	914	53A	33.8	6.24	18.35	D
78	914	53A	34.2	35.35	41.28	D

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
79	914	53A	46.8	65.84	65.77	H
79	914	53A	47.3	67.92	70.33	H
79	914	53A	47.7	33.27	45.11	H
80	914	53A	69.1	36.73	47.40	S
80	914	53A	70.0	40.20	49.69	S
80	914	53A	70.3	34.66	45.87	S
81	914	53A	73.7	18.02	35.93	D
81	914	53A	74.4	5.54	27.52	D
81	914	53A	74.6	38.81	65.79	D
82	914	53A	81.4	32.58	45.87	D
82	914	53A	82.2	7.62	29.26	D
82	914	53A	82.6	6.34	71.10	D
83	914	53A	90.1	41.59	51.99	H
83	914	53A	90.4	40.20	48.16	H
83	914	53A	90.7	42.28	49.59	H
84	914	53A	98.4	32.56	47.40	D
84	914	53A	99.1	9.70	25.99	D
84	914	53A	99.8	74.16	68.04	D
85	914	53A	105.4	26.34	35.93	D
85	914	53A	106.1	4.65	23.05	D
85	914	53A	106.8	46.44	46.63	D
86	914	53A	115.3	[illegible]	42.05	D
86	914	53A	115.9	15.71	29.52	D
86	914	53A	116.3	4.65	64.98	D
87	914	54A	1.8	0.00	13.00	D
87	914	54A	2.2	39.51	38.23	D
87	914	54A	2.3	45.67	42.95	D
88	914	54A	3.9	2.98	50.10	H
88	914	54A	4.1	46.44	39.75	H
88	914	54A	4.4	40.89	39.75	H
89	914	54A	9.3	42.28	55.04	S
89	914	54A	10.0	45.74	44.34	S
89	914	54A	10.9	42.28	41.28	S
90	914	54A	14.3	22.18	21.40	D
90	914	54A	14.6	71.39	45.87	D
90	914	54A	15.1	46.44	52.75	D
91	914	54A	15.2	53.37	36.70	H
91	914	54A	15.4	49.90	38.23	H
91	914	54A	15.9	69.31	37.46	H
92	914	54A	17.6	55.45	56.57	S
92	914	54A	18.3	54.06	50.46	S
92	914	54A	18.5	32.19	43.58	S
92	914	54A	19.1	34.66	50.52	S

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
93	914	54A	25.4	21.49	33.64	D
93	914	54A	26.3	32.63	46.63	D
93	914	54A	26.3	42.28	38.99	D
94	914	54A	29.9	50.60	48.93	H
94	914	54A	30.5	18.71	70.33	H
94	914	54A	30.7	63.07	54.28	H
95	914	54A	34.8	34.66	45.11	S
95	914	54A	35.1	41.59	37.46	S
95	914	54A	35.5	40.20	38.99	S
96	914	54A	81.7	32.58	45.11	D
96	914	54A	82.3	2.08	11.47	D
96	914	54A	82.7	48.52	53.52	D
97	908	64A	18.6	36.96	37.98	D
97	908	64A	19.1	36.19	27.03	D
97	908	64A	20.0	40.81	30.68	D
98	908	67A	23.1	26.18	25.57	D
98	908	67A	23.4	23.10	15.34	D
98	908	67A	24.5	23.10	9.50	D
98	908	67A	25.0	30.03	8.77	D
99	908	68A	8.7	21.56	46.75	D
99	908	68A	9.7	25.41	19.72	D
99	908	68A	10.3	28.49	19.72	D
100	908	68A	15.3	33.88	45.29	A
100	908	68A	16.0	72.38	69.39	A
100	908	68A	16.6	60.06	63.55	A
101	908	68A	26.3	20.79	21.18	D
101	908	68A	26.9	27.72	19.72	D
101	908	68A	27.3	33.11	34.33	D
102	908	68A	71.6	33.88	31.41	D
102	908	68A	72.8	22.33	10.23	D
102	908	68A	73.4	8.47	7.30	D
102	908	68A	74.5	29.26	12.42	D
103	908	68A	99.0	23.87	27.03	D
103	908	68A	100.4	13.86	8.03	D
103	908	68A	100.9	33.11	17.53	D
103	908	68A	101.3	45.43	44.56	D
104	908	68A	117.6	16.17	8.03	D
104	908	68A	118.3	24.64	8.03	D
104	908	68A	118.8	26.95	8.03	D
105	908	69A	40.2	21.56	21.18	D
105	908	69A	40.6	29.26	16.07	D
105	908	69A	41.2	23.10	18.99	D
105	908	69A	41.8	36.96	35.06	D

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
106	908	72A	27.8	22.33	18.26	D
106	908	72A	28.4	31.57	18.26	D
106	908	72A	28.9	51.59	45.29	D
107	908	74A	9.8	33.11	35.06	S
107	908	74A	11.6	30.03	20.45	S
107	908	74A	13.3	35.42	26.30	S
107	908	74A	15.1	37.73	8.03	S
107	908	74A	16.5	28.49	29.94	S
108	908	74A	20.8	15.40	15.34	D
108	908	74A	21.1	45.43	27.76	D
108	908	74A	21.4	43.89	35.79	D
109	908	2B	43.5	39.27	44.56	D
109	908	2B	44.0	20.02	18.99	D
109	908	2B	44.3	23.10	27.03	D
109	908	2B	44.7	7.70	26.30	D
110	908	3B	19.0	12.32	29.21	D
110	908	3B	19.3	30.80	24.10	D
110	908	3B	20.0	25.41	22.64	D
110	908	3B	20.7	58.52	51.86	D
111	908	9B	32.7	30.03	29.21	D
111	908	9B	33.4	10.01	21.18	D
111	908	9B	34.3	28.49	24.10	D
112	908	53B	0.0	23.90	2.90	A
112	908	53B	0.1	47.70	17.50	A
112	908	53B	0.3	41.60	52.60	A
112	908	53B	0.7	43.90	48.20	A
113	908	54B	142.9	42.40	41.60	D
113	908	54B	143.7	26.20	11.70	D
113	908	54B	144.8	24.60	10.20	D
113	908	54B	145.4	37.70	38.00	D
114	908	55B	174.9	18.50	19.70	D
114	908	55B	175.4	11.60	3.60	D
114	908	55B	175.7	20.80	31.40	D
115	908	63B	64.3	23.10	26.60	D
115	908	63B	65.6	23.90	7.70	D
115	908	63B	66.4	47.70	44.80	D
116	908	93B	5.2	32.30	34.30	D
116	908	93B	5.9	15.40	3.60	D
116	908	93B	6.3	36.20	10.20	D
116	908	93B	6.6	40.00	39.40	D

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TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
117	908	93B	11.2	39.30	40.90	D
117	908	93B	11.6	26.20	11.70	D
117	908	93B	12.3	34.70	38.70	D
118	908	93B	12.5	23.10	9.50	A
118	908	93B	12.6	55.40	35.80	A
118	908	93B	12.9	53.10	58.40	A
119	908	93B	30.8	34.70	35.10	D
119	908	93B	31.5	19.20	3.60	D
119	908	93B	32.2	46.20	40.20	D
120	908	93B	32.5	31.60	0.70	H
120	908	93B	32.8	40.00	59.20	H
120	908	93B	33.0	46.20	48.20	H
121	908	93B	33.6	13.90	16.10	A
121	908	93B	34.0	45.40	59.20	A
121	908	93B	34.8	44.70	46.10	A
122	908	93B	86.7	30.80	31.40	D
122	908	93B	87.1	23.90	6.60	D
122	908	93B	87.7	32.30	35.10	D
123	908	93B	156.6	20.00	22.00	D
123	908	93B	157.2	40.80	19.70	D
123	908	93B	157.5	33.90	32.10	D
124	908	93B	178.8	19.20	23.40	D
124	908	93B	179.5	45.40	14.60	D
124	908	93B	179.7	32.30	29.90	D
125	908	93B	249.3	9.20	15.30	A
125	908	93B	249.6	46.20	65.00	A
125	908	93B	250.2	48.50	[illegible]	A
126	908	93B	226.4	25.40	6.60	A
126	908	93B	226.5	46.20	13.90	A
126	908	93B	226.8	40.80	48.20	A
127	908	93B	217.6	45.40	46.80	D
127	908	93B	218.2	70.10	46.10	D
127	908	93B	218.5	29.30	32.10	D
128	908	93B	201.0	19.20	[illegible]	A
128	908	93B	201.2	57.00	[illegible]	A
129	908	93B	201.5	44.70	46.80	A

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

TABLE II - contd.

Sample Number	Aircraft Number	Flight Number	Time (min)	Torque (pct) 1	Torque (pct) 2	Flight Condition*
130	908	93B	191.4	25.40	10 20	A
130	908	93B	191.5	48.50	19.70	A
130	908	93B	191.7	57.80	63.60	A
131	908	93B	180.1	26.20	5.10	A
131	908	93B	180.2	50.10	22.60	A
131	908	93B	180.4	77.00	80.30	A
132	908	15C	12.0	19.25	18.99	D
132	908	15C	12.3	23.87	6.57	D
132	908	15C	12.5	23.87	25.57	D
133	908	15C	136.0	23.10	19.72	D
133	908	15C	136.4	20.02	8.77	D
133	908	15C	137.0	39.27	34.33	D
134	908	15C	303.2	16.94	18.26	D
134	908	15C	303.7	25.41	10.23	D
134	908	15C	304.1	30.03	27.03	D
135	908	16C	105.5	30.03	28.49	D
135	908	16C	108.3	16.94	7.30	D
135	908	16C	115.0	27.72	12.42	D
135	908	16C	119.7	49.28	39.44	D
136	908	17C	69.1	22.33	18.99	D
136	908	17C	69.4	24.64	6.57	D
136	908	17C	69.7	31.57	28.49	D
137	908	17C	75.6	20.79	18.26	D
137	908	17C	75.9	20.02	9.50	D
137	908	17C	76.3	30.03	37.03	D
138	908	17C	202.4	33.11	34.33	D
138	908	17C	202.9	28.49	18.26	D
138	908	17C	203.1	23.87	26.30	D
139	908	53B	18.7	24.60	11.00	D
139	908	53B	18.8	48.50	38.00	D
139	908	53B	19.5	42.40	48.90	D
140	908	9B	22.8	22.33	17.53	D
140	908	9B	22.9	20.79	15.34	D
140	908	9B	22.9	3.85	13.88	D

*D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

Sample Number	Condition	Sample Number	Condition	Sample Number	Condition
1	D	63	D	125	D
2	L	64	D	126	D
3	S	65	D	127	D
4	S	66	M	128	D
5	D	67	S	129	D
6	S	68	D	130	D
7	D	69	D	131	D
8	A	70	D	132	D
9	D	71	S	133	D
10	D	72	D	134	D
11	D	73	D	135	D
12	A	74	D	136	D
13	D	75	S	137	D
14	D	76	S	138	D
15	A	77	S	139	D
16	A	78	D	140	D
17	D	79	D	141	D
18	A	80	D	142	D
19	D	81	D	143	S
20	H	82	D	144	A
21	S	83	D	145	S
22	S	84	D	146	D
23	A	85	D	147	D
24	S	86	D	148	D
25	D	87	D	149	D
26	A	88	D	150	D
27	D	89	D	151	D
28	A	90	D	152	S
29	D	91	D	153	D
30	A	92	D	154	D
31	D	93	D	155	A
32	S	94	D	156	D
33	D	95	D	157	D
34	A	96	D	158	S
35	D	97	D	159	S
36	D	98	D	160	S
37	A	99	D	161	S
38	S	100	D	162	A
39	S	101	D	163	D
40	A	102	D	164	S
41	D	103	D	165	S
42	A	104	D	166	D
43	A	105	D	167	D
44	A	106	D	168	D
45	S	107	D	169	D
46	S	108	D	170	D
47	S	109	D	171	D
48	S	110	D	172	A
49	D	111	D	173	S
50	A	112	D	174	S
51	D	113	D	175	D
52	S	114	D	176	H
53	M	115	D	177	D
54	S	116	D	178	D
55	S	117	D	179	A
56	D	118	D	180	D
57	D	119	D	181	D
58	D	120	D	182	D
59	D	121	D	183	A
60	S	122	D	184	D
61	A	123	D	185	A
62	A	124	D	186	A

D - Descent; S - Steady; A - Ascent; M - Maneuver; H - Hover

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) US Army Aviation Materiel Laboratories Fort Eustis, Virginia	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

CH-47A CHINOOK ENGINE LOAD SHARING

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Engineering Laboratory Report

5. AUTHOR(S) (First name, middle initial, last name)

L. R. Bartek
R. Hunt

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
November 1968	81	1

8a. CONTRACT OR GRANT NO. b. PROJECT NO. 1M131201D14415 House Task EL 65-29 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) USAAVLABS Technical Report 68-80 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT

This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY US Army Aviation Materiel Laboratories Fort Eustis, Virginia

13. ABSTRACT

The Army is concerned with the problem of unequal load sharing by the engines in its multiengine helicopters. Findings of an engine load-sharing study conducted on the CH-54A Skycrane helicopter in 1965 led to a similar study on the CH-47A Chinook helicopter.

Airspeed, altitude, engine gas producer rpm, engine torque, exhaust gas temperature, main rotor rpm, and outside air temperature were recorded during various flight conditions. The gross weight at takeoff and landing and the barometric pressures were also recorded as supplemental data. The data are presented in a series of histograms and tables showing the variations in engine load sharing as a function of the other aircraft parameters.

It was found that for the CH-47A Chinook, the relative frequency of occurrence of torque splits greater than 20 percent is less than one-half that for the CH-54A Skycrane.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified

Security Classification

Unclassified

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Heavy-Lift Helicopters						
Helicopter Engine Load Sharing						
Operational Helicopter Data						

Unclassified

Security Classification

12510-68